PB-229 323

PROCEEDINGS. CONFERENCE IN THE MATTER OF POLLUTION OF THE NAVIGABLE WATERS OF THE DETROIT RIVER AND LAKE ERIE AND THEIR TRIBUTARIES IN THE STATE OF MICHIGAN. VOLUME 3, SECOND SESSION 15-18 JUNE 1965

Public Health Service
Washington, D. C.

June 1965

DISTRIBUTED BY:

NTIS
National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 229 323

PROCEEDINGS

VOLUME 3

Conference

In the matter of Pollution of the navigable waters of the Detroit River and Lake Erie and their Tributaries in the State of Michigan

SECOND SESSION JUNE 15-18, 1965

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service

CONTENTS

PAGE:

OPENING STATEMENT
By Mr. Stein 3

STATEMENT OF:

REPRESENTATIVE JOHN D. DINGELL 16

REPRESENTATIVE WILLIAM D. FORD 30

RICHARD D. VAUGHAN 44

GEORGE L. HARLOW 703

ERNEST PREMETZ 852

GOVERNOR GEORGE ROMNEY 858

GOVERNOR JAMES RHODES 871

REPRESENTATIVE WESTON E. VIVIAN 880

COLONEL EDWARD C. BRUCE 912

LIEUTENANT MAURICE S. POWER 927

KENNETH MACKENTHUN 1013

GERALD EDDY 1015

RALPH PURDY 1028
1092

JOHN E. VOGT 1035

C. C. CRUMLEY 1062

AL BARBOUR 1075

MERLIN DAMON 1110

TODD A. CAYER 1112

JOHN CHASCSA 1118

GERALD REMUS 1231

CONTENTS

	PAGE:
STATEMENT OF:	
GERARD H. COLEMAN	1435
GEORGE E. HUBBELL	1440
GEORGE J. HAZEY	1465
GENE LITTLE	1478
JAMES D. OGDEN	1490
OLGA M. MADAR	1493
FRED E. TUCKER	1505-A
HAYSE H. BLACK	1564
ROBERT C. McLAUGHLIN	1570
FRANK KALLIN	1582
A. J. VON FRANK	1607
ROBERT P. LOGAN	1622
JACK T. GARRETT	1651
WILLIAM R. DAY	1655
J. W. TRACHT	1662
C. D. BARRETT, SR., M.D.	1716
STANLEY DIROFF	1749
WILLIS H. HALL	1771
CLOSING STATEMENT Mr. Stein	1782

Richard D. Vaughan

North (5 per cent occurrence)

Water movement in the Michigan waters of Lake Erie is predominantly southerly to south-southwesterly for a north wind. Thus, Detroit River water would be transported south to Stony Point and across the Raisin River Channel if this wind condition prevailed for a sufficient length of time. Little data was obtained in Brest Bay on north winds, but from what is available, a generally southerly current pattern, paralleling the shoreline, may be assumed. It does not appear likely that Detroit River water moves west in the Bay as far as the beaches, however. East of the Project study area, movement is to the south in the vicinity of the Detroit River Light, becoming southeasterly as distance from the River mouth increases.

Northeast (9 per cent occurrence)

The predominant current direction for a northeast wind is southwesterly. As was the case with a north wind, Detroit River water could enter Brest Bay if a strong northeasterly wind persisted for a day or two. Field observations made during April and May of 1964 show that water movement near the beach at Sterling State Park is variable but generally has a southerly component for this wind condition. This variability is probably due to unsteady water levels caused by seiche action or wind set-up while field measurements were being performed.

East (7 per cent occurrence)

The current pattern for an east wind is somewhat more complicated than for the two wind conditions just mentioned. Water movement in the West Outer and East Outer Channels is southwesterly near the Detroit River Light, becoming westerly near the ends of the channels as wind becomes the dominant force over the River current, which dissipates with distance from the mouth.

In the area from Point aux Peaux north to Pointe Mouillee, the water mass appears to rotate in a clockwise direction when east winds are strong. Thus currents along the beach in this area are northerly for this situation. This was substantiated by results obtained by Dr. Ayers, of the University of Michigan, in a current pattern study at the Enrico Fermi Atomic Reactor.

In Brest Bay, at Stony Point, and in the area immediately to the east of the Bay, water movement is to the west. Studies made by the Project at Sterling State Park in 1964 show that currents along the beach are quite variable for an east wind, and appear to depend on water level fluctuations in the area at the time of observation. For an east wind, water passing the beach at Sterling State Park could be moving north from the Raisin River, west from Brest Bay, or South from the Stony or Sandy Creek areas.

In that part of the Detroit River debouchment lying to the east of the Detroit River Light and the channels, an east wind appears to cause a large-scale, counter-clockwise rotation of surface waters.

Southeast (15 per cent occurrence)

Current patterns in the case of a southeast wind are quite similar to patterns for an east wind, except that the clockwise circulation pattern in the Swan Creek area occurs more frequently as the wind intensity required to cause rotation is lower when the wind has a southerly component.

In Brest Bay and nearby areas, water movement is predominantly northwest.

Along the beach at Sterling State Park currents are most frequently northerly but may also be to the south. This again is most likely due to localized differences and changes in water level.

South (11 per cent occurrence)

Overall water movement in the northern part of the study area is to the south and southeast under the influence of a south wind. To the south, where the effect of the Detroit River current is little felt, water movement is north-northeast. Upon meeting, in the area south of the East Outer and West Outer Channels, the two water masses appear to resolve into one, moving along an easterly course.

Currents alongshore in the Swan Creek area are northerly, creating an eddy in the area from shore to the West Outer Channel.

In Brest Bay, and along the beaches in the bay, water movement is to the north.

Southwest (24 per cent occurrence)

For a southwest wind, currents are predominantly southeast in the northern sector and northeast in Brest Bay and the area east of the Bay.

Water movement alongshore in the Swan Creek area is northerly, turning to the southeast in the vicinity of Pointe Mouillee.

Flow along the beach at Sterling State Park is northerly for a southwest wind. Thus, water quality on the beach will likely be influenced by the Raisin River.

West (10 per cent occurrence)

Water movement is easterly for a west wind of moderate to high intensity. At Sterling State Park, currents alongshore are northeasterly most of the time for this wind condition.

For a light west wind, waters in Brest Bay were found, on one occasion, to be circulating in a clockwise direction. At that time currents in the area to the east of the Bay were southerly.

Northwest (13 per cent occurrence)

Current patterns are south to southwesterly for a northwest wind. Currents alongshore in the Swan Creek area are southerly. Thus, Detroit River water can move south to Stony Point, and possibly into Brest Bay.

Summary of Findings

1. In open water sections of the Lake Erie study area, away from the mouth of the Detroit River, currents generally move with the prevailing wind.

2. At the mouth and in the debouchment, the Detroit River current is most important in determining patterns of water movement. The usual south-to-southeast-to-east path traced by water moving from the River mouth into the debouchment, and finally out into the Lake, is modified somewhat by east, southeast, and south winds. Under the influence of these winds, a counter-clockwise circulation pattern is set up in the area east of the East Outer Channel.

3. Along the beaches from Point aux Peaux north past Swan Creek, two types of current patterns occur. When winds are from the west, north, and east, which is approximately 50 per cent of the time, water movement is southerly, directly from the Detroit River. For all southerly winds, flow alongshore is northerly. For a southeast wind, and possibly for a south wind, also, the northerly current movement along the beaches is part of a clockwise circulation pattern extending from shore to the West Outer Channel. Thus Detroit River water can affect water quality along the beaches in the vicinity of Swan Creek 75 to 85 per cent of the time.

4. At Sterling State Park, northerly water movement may be expected to occur regularly for south-through-west winds. Thus, at least 40 to 45 per cent of

the time, Raisin River water can reach the beach areas to the north.

5. Direct water transport from the mouth of the Detroit River into Brest Bay is possible but probably occurs only rarely. Winds from the northeast and east, which occur approximately 20 per cent of the time, could accomplish this if they blew steadily for two days or more.

STERLING STATE PARK BEACH SURVEY

Sterling State Park is a large recreational area located on Lake Erie just north of the mouth of the Raisin River. Among its facilities is a large expanse of bathing beach on Lake Erie. Approximately 1,200,000 people used the Park in 1959.

Following investigation and evaluation by personnel of the Michigan Water Resources Commission and the Michigan Department of Health, and on their advice, the Sterling State Park was posted as unsafe for swimming by the Michigan Department of Conservation in August, 1961. The State agencies, in a special report to the Michigan Water Resources Commission, listed several possible sources of waste capable of degrading the sanitary water quality of Sterling State Park, including (a) municipal effluent from Detroit, Wyandotte, Trenton, and Monroe; (b) overflow from combined sewers in the southeast Michigan area; (c) wastes from shorefront homes; and (d) industrial wastes from paper mills in the Monroe area.

The problem of water quality at the Sterling State Park and the waste sources and conditions which degrade this quality is complex and defies a simple solution. Average or geometric mean coliform values at this beach during the Project's duration indicated satisfactory water quality. However, grab samples collected after certain conditions of wind and rainfall showed exceptionally high coliform densities.

To explain these puzzling results a special investigation of the Park was undertaken by Project personnel with an engineering consultant called in for this purpose.

Description of Area

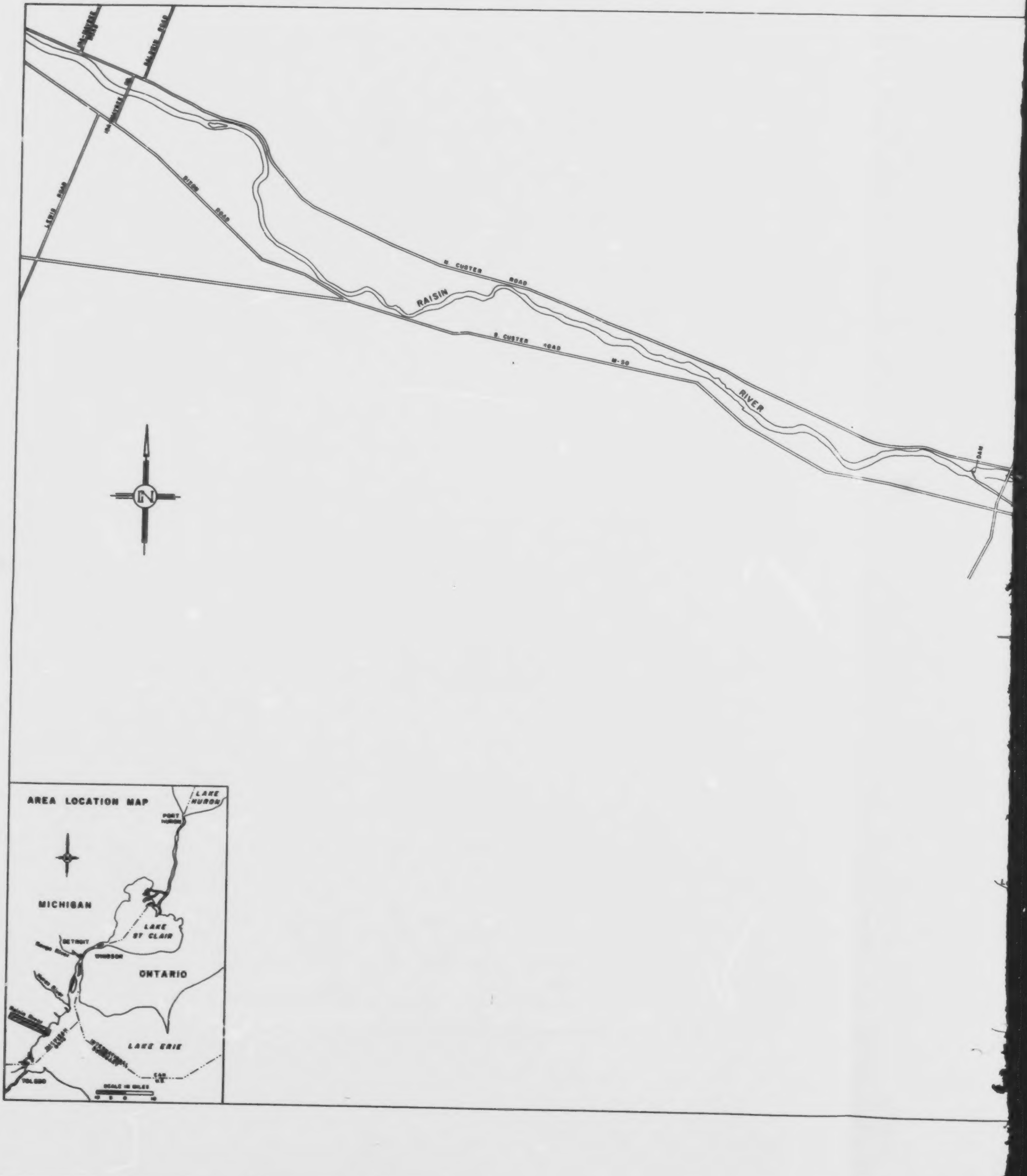
Sterling State Park is located on Brest Bay north of the Raisin River extending north to the mouth of Sandy Creek. The Park has approximately 7,400 feet of beach shoreline on Lake Erie, and inland waters directly adjacent to Sterling State Park have an area of approximately 245 acres. The water in the inland ponds adjacent to and within Sterling State Park is generally used for boating, fishing, and water skiing. Water taken for industries in the Monroe area passes through these ponds, the sources being Sandy Creek and Lake Erie water.

Water level changes in Lake Erie affect water movement into and out of the inland ponds, resulting in appreciable flows during these periods of rapid water level changes. It is not uncommon for the water level in Lake Erie to change 1 foot within a 6-hour period, which would result in an average water movement for this period of approximately 500 cfs. Since the water consumption of the industries using this water is approximately 200 cfs. the quality of water in the inland areas is partly dependent on the quality of water drawn in from the west end of Lake Erie.

Figure 19-VI shows the area covered by this investigation and the sampling points referred to in this report.

Table 26-VI describes the sampling points; and Table 27-VI lists the results of the bacteriological investigation of the Sterling State Park area, accompanied by pertinent weather data and remarks.

(Figure 19-VI; Table 26-VI, and Table 27-VI follow.)


N CUSTER ROAD
RAISIN
S CUSTER ROAD
M-50
RIVER
DAM
DIXON ROAD
LEWIS ROAD
N
AREA LOCATION MAP
LAKE HURON
PORT HURON
MICHIGAN
LAKE ST CLAIR
DETROIT
WINDSOR
ONTARIO
LAKE ERIE
TOLEDO
CAN
U.S.
SCALE IN MILES
10
5
0
10

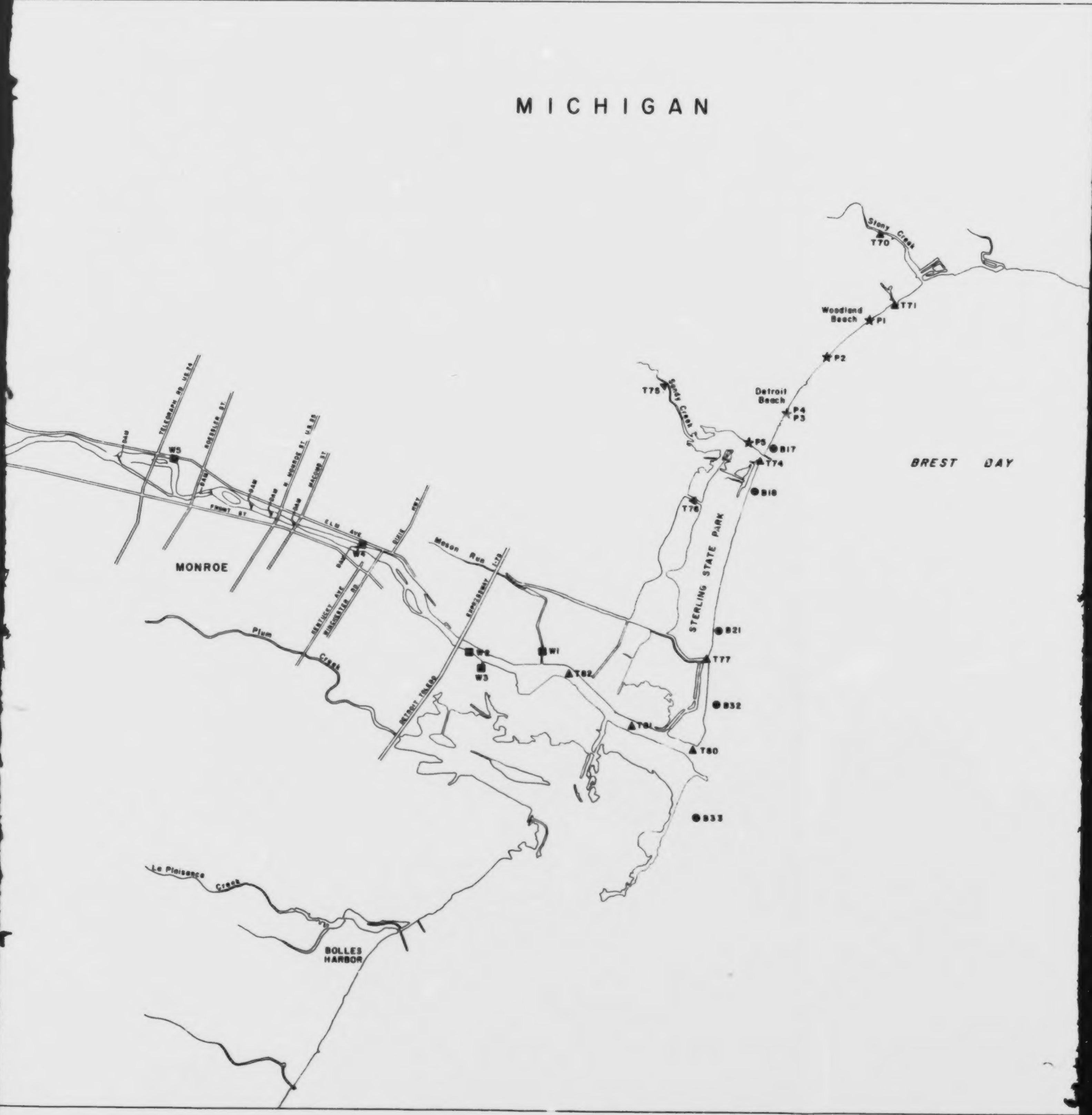
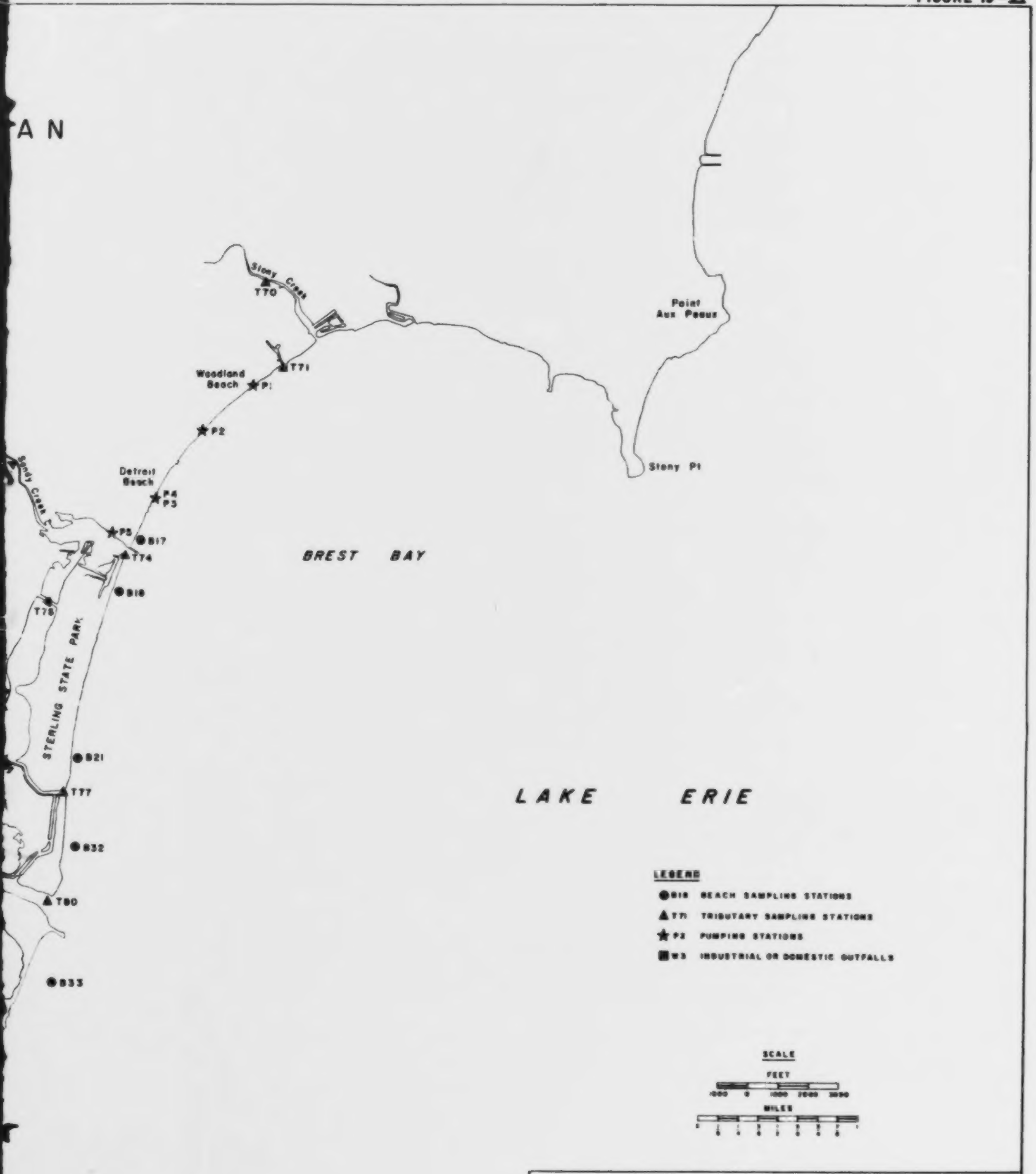

MICHIGAN
Stony Creek
T70
T71
Woodland Beach
P1
P2
Detroit Beach
P4
P3
T75
Sandy Creek
P5
B17
T74
BREST BAY
B18
T76
STERLING STATE PARK
DAM
TELEGRAPH RD U.S.24
W5
ROESSLER ST
DAM
DAM
DAM
N. MONROE ST U.S.25
DAM
MACOMB ST
FRONT ST
ELM AVE
DIXIE HWY
W4
DAM
Mason Run
I-75
MONROE
KENTUCKY AVE
WINCHESTER RD
EXPRESSWAY
Plum Creek
DETROIT TOLEDO
W2
W3
W1
T82
B21
T77
B32
T81
T80
B33
La Plaisance Creek
BOLLES HARBOR

FIGURE 19-VI


A N
Stony Creek
T70
Point Aux Peaux
T71
Woodland Beach
P1
P2
Detroit Beach
P4
P3
Sandy Creek
P5
B17
T74
B18
T78
STERLING STATE PARK
B21
T77
B32
T80
B33
Stony Pt
BREST BAY
LAKE ERIE
LEGEND
● B18 BEACH SAMPLING STATIONS
▲ T71 TRIBUTARY SAMPLING STATIONS
★ P2 PUMPING STATIONS
■ W3 INDUSTRIAL OR DOMESTIC OUTFALLS
SCALE
FEET
1000 0 1000 2000 3000
MILES

DETROIT RIVER-LAKE ERIE PROJECT

LOCATION OF SAMPLING STATIONS
STERLING STATE PARK SURVEY

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
REGION V GROSSE ILE, MICHIGAN

TABLE 27-VI. RESULTS OF BACTERIOLOGICAL INVESTIGATION OF STERLING STATE PARK BATHING BEACHES APRIL - MAY, 1964

Date	Sta.	Gen. Wind Dir.	Current Direction off Park	Remarks and Weather Observations	Total Coliform Density[1] Organisms/100ml	Fecal Coliforms Percent	Fecal Coliforms Per 100ml	Fecal Strep Org/100ml	Ratio F. Col. / F.Strep
4/6/64	T75				35,000	5	1,750	180	10:1
	B17				1,600	12	190	70	3:1
	T74	Lt.		Partly cloudy	4,000			100	
	B18	S	NNE	with wind up	1,700	10	170	40	4:1
	B21			to 10 knots	2,100	10	210	70	3:1
	T77			Light rain	1,000			20	
	B32				1,100	10	110	10	11:1
4/7/64	T75				1,200	20	240	180	1:1
	B17	Lt to		Cloudy with no	800				
	T74	mod.		significant	300			60	
	B18	W		rain	2,500	25	620	110	6:1
	B21				8,400	45	3,800	360	11:1
	T77				6,600	35	2,300	300	8:1
	B32				2,400	5	120	70	2:1
	T80				51,000	25	12,500	460	27:1
	T81				58,000	40	23,000	630	36:1
	T82				71,000	45	32,000	550	58:1
	B33				24,000	25	6,000	490	12:1
4/8/64	T75				10,000	30	3,000	290	10:1
	B17				4,100	15	615	40	15:1
	T74			Cloudy with	8,300	10	830	120	7:1
	B18	Mod.		light rain and	5,900	25	1,500	20	75:1
	B21	W		winds up to	6,600	35	2,300	40	57:1
	T77			20 knots	6,300	50	3,150	40	79:1
	B32			Flow is out-	1,000	8	80	10	8:1
	T80			ward at T74	53,000	50	26,500	840	32:1
	T81			and T77	35,000	20	7,000	900	8:1
	T82				31,000	45	14,000	750	22:1
	B33				40,000	10	4,000	840	5:1

TABLE 26-VI. DESCRIPTION OF SAMPLING POINTS STERLING STATE PARK SURVEY

T80	Raisin River at the mouth
T81	Raisin River 0.5 miles upstream from the mouth
T82	Raisin River 1.13 miles upstream from the mouth
T70	Stony Creek at River Road
T71	Mouth of small boat harbor about 1,500 feet south of the mouth of Stony Creek
T74	Mouth of Sandy Creek
T75	Sandy Creek at River Road
T76	Culvert pipe under the road crossing the lagoon west of Sterling State Park's bathing beach
T77	Mouth of the stream on the extreme southern end of Sterling State Park's bathing beach
B17	Detroit Beach north of Sandy Creek
B18	Sterling State Park (northern end)
B21	Sterling State Park (southern end)
B32	Midway between the Raisin River and Sterling State Park
B33	2,500 feet south of the Raisin River
P1	Woodland Beach Pumping Station
P2	Grand Beach Pumping Station
P3) P4)	Detroit Beach twin pumping station
P5	Detroit Beach Pumping Station along Sandy Creek
W1	Mason Run
W2	Monroe Sewage Treatment Plant outfall
W3	Consolidated Paper Company - south outfall
W4	Consolidated Paper Company - north outfall
W5	Monroe Paper Products outfall

TABLE 27-VI. RESULTS OF BACTERIOLOGICAL INVESTIGATION OF STERLING STATE PARK BATHING BEACHES APRIL - MAY, 1964 (CONTINUED)

Date	Sta.	Gen. Wind Dir.	Current Direction off Park	Remarks and Weather Observations	Total Coliform Density Organisms/100ml	Fecal Coliforms		Fecal Strep Org/100ml	Ratio F. Col. / F.Strep.
						Percent	Per 100ml		
4/13/64	T75			Cloudy with	11,000	5	550	50	11:1
	B17			wind gusts up	83,000	5	4,150	240	17:1
	T74	Strong		to 30 knots.	95,000	5	4,750	170	28:1
	B18	S	N	No significant	106,000	15	16,000	290	55:1
	B21			rain for previous	190,000	25	47,500	310	153:1
	T77			3 days.	95,000	20	19,000	210	90:1
	B32				110,000	25	27,500	370	75:1
	T80				132,000	5	6,500	460	14:1
	T81				92,000	10	9,200	780	12:1
	T82				45,000	30	13,500	840	16:1
	B21				380,000	5	19,000	250	76:1
4/14/64	B21	Strong S		No sign rain for last 4 days	88,000	5	4,400	100	44:1
4/15/64	B21	Mod W		No rain	220,000	10	22,000	10	2200:1
4/16/64	B21	Mod SSE		No rain	1,040,000	10	104,000	270	385:1
4/20/64	T75			Cloudy with	33,000	10	3,300	340	9:1
	B17	Mod		light rain.	10,000	10	1,000	70	14:1
	T74	E	NE	Currents on	65,000	5	3,250	100	32:1
	B18		to	north edge	52,000	5	2,600	40	65:1
	B21		SE	of Park	16,000	5	800	30	27:1
	T77			tended to go	40,000	5	2,000	60	33:1
	T82			NE while on	66,000	5	3,300	270	12:1
	T81			the southern edge they	49,000	10	4,900	350	14:1

TABLE 27-VI. RESULTS OF BACTERIOLOGICAL INVESTIGATION OF STERLING STATE PARK BATHING BEACHES APRIL - MAY, 1964 (CONTINUED)

Date	Sta.	Gen. Wind Dir.	Current Direction off Park	Remarks and Weather Observations	Total Coliform Density Organisms/100ml	Fecal Coliforms		Fecal Strep Org/100ml	Ratio F. Col./F.Strep.
						Percent	Per 100ml		
4/20/64 (cont.)	T82			tended to go SE. Winds ranged up to 18 knots	84,000	10	8,400	260	32:1
	B33				71,000	10	7,100	180	40:1
4/21/64	T75	E to SE	SE to NE	Moderate rain in morning. Winds 5 to 10 knots shifting from E to SE. No significant rain in previous two days. Currents southerly except for north edge of park.	24,000	5	1,200	480	3:1
	B17				14,000	10	1,400	50	28:1
	T74				7,000	5	350	40	9:1
	B18				18,000	10	1,800	40	45:1
	B21				11,000	10	1,100	20	55:1
	T77				12,000	5	600	10	60:1
	T80				180,000	15	27,000	640	42:1
	T81				122,000	5	6,100	940	7:1
	T82				160,000	15	24,000	1,180	20:1
4/22/64	T75	Mod. WSW	NE	75% Sky cover. Winds blowing from 10 to 20 knots. No rain. Flow is outward at T77 and T74 on this date which is unusual.	10,800	25	2,450	200	12:1
	B17				7,300	7	500	60	8:1
	T74				18,000	5	900	40	22:1
	B18				22,000	15	3,300	40	82:1
	B21				32,000	10	3,200	40	80:1
	T77				83,000	10	8,300	140	59:1
	B32				16,000	25	4,000	100	40:1
	T80				88,000	35	31,000	480	65:1
	T81				120,000	25	30,000	500	60:1
	T82				117,000	35	41,000	1,260	33:1
	B33				2,000	10	200	40	5:1

TABLE 27-VI. RESULTS OF BACTERIOLOGICAL INVESTIGATION OF STERLING STATE PARK BATHING BEACHES APRIL - MAY, 1964 (CONTINUED)

Date	Sta.	Gen. Wind Dir.	Current Direction off Park	Remarks and Weather Observations	Total Coliform Density Organisms/100ml	Fecal Coliforms			Ratio F. Col. / F. Strep.
						Percent	Per 100ml	Org/100ml	
4/23/64	T75				3,800	25	950	180	5:1
	B17			25% Sky cover, Winds blowing at 5-10 knots.	4,800	20	960	20	48:1
	T74				4,800	15	720	10	72:1
	B18				7,800	5	390	10	39:1
	B21	Lt. SE			5,100	10	510	10	51:1
	T77		NNE		3,100	30	930	10	93:1
	B32				5,500	10	550	10	55:1
	T80			No rain	42,000	15	6,400	720	9:1
	T81				58,000	20	10,600	440	24:1
	T82				58,000	40	23,000	1,340	17:1
	B33				49,000	15	7,400	60	123:1
4/27/64	B21	Lt. ESE		Cloudy with rain, wind 7-10 knots	5,000	20	1,000	10	100:1
	T80		N		62,000	9	5,600	620	9:1
4/28/64	B21	Lt. S	N	Partly cloudy Wind 2-4 knots	39,000	10	3,900	60	65:1
4/29/64	T75				24,000				
	B17	Lt. S		Cloudy with Wind 8 knots	14,000			520	
	B18		N		10,000	20	2,000	20	100:1
	B21				35.000			10	
	T80				89,000	5	4,400	320	14:1
	T81				116,000	5	5,800	1,140	5:1
	T82				109,000	5	5,400	1,280	4:1
4/30/64	B21	Lt. ENE	S	Rain; wind 6-8 knots	72,000	5	3,600	260	14:1

TABLE 27-VI. RESULTS OF BACTERIOLOGICAL INVESTIGATION OF STERLING STATE PARK BATHING BEACHES APRIL - MAY, 1964 (CONTINUED)

Date	Sta.	Gen. Wind Dir.	Current Direction off Park	Remarks and Weather Observations	Total Coliform Density Organisms/100ml	Fecal Coliforms		Fecal Strep Org/100ml	Ratio F. Col./F. Strep.
						Percent	Per 100ml		
5/4/64	B21				11,000	10	1,100	100	11:1
5/5/64	T75				5,900	5	290	80	4:1
	B17	Lt. SE	SE	Mostly fair with wind 5-10 m.p.h. Flow at extreme north end of Park was northerly	1,000	10	100	10	10:1
	T74				5,000	-	-	20	
	B18				600	-	-	10	
	B21				2,100	10	210	10	21:1
	T77				900	10	90	10	9:1
	B32				4,400	5	220	10	22:1
5/6/64	B21	Lt. SE	NE	Mostly fair with about 10 m.p.h. winds	1,300	6	80	100	0.8:1
5/7/64	T75				3,800	10	380	160	2:1
	B17	Mod SSW	N		31,000	10	3,100	10	310:1
	T74			Fair skies with no rain for several days	7,100	10	710	10	71:1
	B18				26,000	10	2,600	10	260:1
	B21				31,000	10	3,100	10	310:1
	T77				39,000	10	3,900	10	390:1
	B32				54,000	10	5,400	10	340:1
	T80				86,000	10	8,600	70	122:1
	T81				250,000	10	25,000	300	83:1
	T82				360,000	10	36,000	340	106:1
	B33				63,000	5	3,100	40	77:1

TABLE 27-VI. RESULTS OF BACTERIOLOGICAL INVESTIGATION OF STERLING STATE PARK BATHING BEACHES APRIL - MAY, 1964 (CONTINUED)

Date	Sta.	Gen. Wind Dir.	Current Direction off Park	Remarks and Weather Observations	Total Coliform Density Organisms/100ml	Fecal Coliforms		Fecal Strep Org/100ml	Ratio F. Col. / F. Strep.
						Percent	Per 100ml		
5/8/64	T75	Lt to mod S		Thunderstorm passed through the area about six hours before sampling. Winds during sampling were about 10-12 m.p.h.	77,000	5	3,800	5,500	0.7:1
	B17				47,000	5	2,300	100	23:1
	T74		N		84,000	5	4,200	100	42:1
	B18				66,000	5	3,300	100	33:1
	B21				120,000	5	6,000	100	60:1
	T77				75,000	5	3,800	100	38:1
	B32				45,000	5	2,300	100	23:1
	T80				320,000	5	16,000	100	160:1
	T81				400,000	5	20,000	100	200:1
	T82				470,000	5	23,000	100	230:1
	B33				1,300	10	130	100	1:1

Present Water Quality Conditions

The bacteriological quality of water is expressed in terms of total coliform, fecal coliform, and fecal streptococcus density; the standard frequently accepted for swimming purposes, in terms of total coliforms, is 1,000 per 100 ml of water. Coliforms are associated with the enteric tract of warmblooded animals and are quite common in soil as a natural habitat. In waters free from pollution except from natural surface sources the density of fecal coliform will always be considerably lower than the total coliform density, usually about 5 per cent of the total. Consequently, high ratios of fecal coliform to total coliform indicate the presence of pollution from human wastes.

During April, May, and the first two weeks in June of 1963, the water quality on the beaches adjacent to Sterling State Park did not meet the standard for swimming. In July and August, however, coliform results were consistently low enough to permit safe swimming. When sampling was resumed late in October, the water quality was borderline, and during the latter part of November the bacteriological counts were again very high.

The quality of the water was poor throughout the survey conducted during April and the first week of May, 1964. The highest coliform count was observed on April 16, when the coliform density at its southern end was 1,040,000 per 100 ml. Coliform counts in both the Raisin River on the southern end of the Park and in Sandy Creek at River Road on the northern end of the Park were, with only one or two exceptions, always in the five- and six-figure range.

Winds throughout the survey periods were observed from all quadrants, and the currents off the park traveled in both southerly and northerly directions. Currents at the mouth of Sandy Creek were flowing upstream and subsequently into the paper mills' intakes on all but two occasions during the sampling periods. On these two days, winds were moderate from the west, the Lake level was falling, and current in the Raisin River was flowing in and out about an equal number of times.

Overall values for the total coliforms at Sterling State Park ranged from less than 20 to 1,040,000 per 100 ml. At times, the percentage of fecal coliforms in the total coliform count approached 90, indicating the severity of the potential health hazard. Although fecal coliforms were generally less than 20 per cent of total coliforms, the fecal coliform counts were over 1,000 per 100 ml on the majority of occasions. In addition, the ratio of fecal coliforms to fecal streptococci at the Park and Detroit Beach was usually high, over 1,000: 1 on one occasion. Recent research studies have shown that when the ratio of fecal coliforms to fecal streptococci exceeds 2 : 1, the fecal bacteria have a human origin. Thus it is apparent that despite the fact that the majority of the coliforms in the waters at Sterling State Park were non-fecal during the 1964 survey, the remaining fecal bacteria are from a human origin and in high enough populations to cause a definite health hazard.

Fecal streptococcus counts during the 1964 survey were low, ranging from 10 per 100 ml to 840 per 100 ml. Counts in the Raisin River, although higher, were still relatively low. The highest count in the River during the survey was 1,340 per 100 ml. Fecal streptococcus counts in Sandy Creek reached a high of 5,500 per 100 ml on May 8, when the Creek was carrying the runoff of an early morning thunderstorm.

Although high bacteriological densities at the Sterling State Park beaches are of chief concern and were the cause of declaring the beach unsafe for swimming, other water quality problems exist. One particularly distressing condition during the summer months is the washing up on shore of floating, decaying organic material. This obnoxious material is the result of the deposition of settleable solids near the mouth of the Raisin River in waters devoid of dissolved oxygen because of the discharge of large quantities of oxygen-demanding wastes into this river. The settled material or sludge decays and, under anaerobic conditions, raises to the surface in a putrefied condition and floats out into Lake Erie and onto the bathing beach.

Sources of Pollution

In the Brest Bay area there are a number of sources of pollution which can affect water quality in Sterling State Park.

North of Sterling State Park a number of unsewered communities rely on septic tanks for waste disposal, the liquid products of which may find their way to drainage ditches and thereafter be discharged into Lake Erie by gravity or by stormwater pumping station. Although the flow volume from these communities is small, because of the limited degree of treatment provided the concentration of pollutants can be excessively high. In some instances shorefront homes discharge septic tank effluent directly into the Lake. Homes not on shorefront property often discharge septic effluent to absorption tiles. The effectiveness of this method of disposal is limited by the absorptiveness of the soil and the groundwater level. Some absorption tile fields are directly connected to drainage ditches or storm sewers to be discharged into Lake Erie. A stormwater collection system carries the water to pumps from where it is discharged intermittently to Lake Erie at stormwater pumping stations.

Several storm pumps located in the Detroit Beach area directly north of Sterling State Park were sampled to determine the quality of water discharged. Most of the pumps discharge only during rainy periods; consequently, only a limited number of samples were obtained. The results are tabulated in Table 28-VI and show that the bacteriological quality of their discharge was poor on most occasions. The pump located on the southern edge of Detroit Beach (see Figure 19-VI) operated in both wet and dry weather. Coliform results ranged from 740,000 during a rain to 6,000 during dry weather.

Other pumping stations showed coliform counts ranging from 790,000 to 116,000. Fecal coliform for all stations averaged below 15 per cent and fecal streptococci ranged from a low of 210 to a high of 49,000.

Other sources of pollution are the wastes of seven major industries and the domestic waste from the City of Monroe, all of which discharge into the Raisin River. The Raisin River discharges into Lake Erie approximately 1 mile south of the Sterling State Park area.

The City of Monroe provides primary treatment and chlorinates the effluent from the middle of May to the middle of September. Surveys show that chlorination can reduce the coliforms in the effluent to less than 10 per 100 ml. Without chlorination, effluent coliform values were as high as 110,000,000 per 100 ml. Flow through the plant usually ranges from 2 to 6 MGD. The collection system is capable of carrying 16 MGD to the sewage treatment plant, however, and during periods of excessive rainfall large quantities of untreated waste are discharged to the River. In terms of BOD loading, the wastes discharged from the paper industries have a population equivalent of approximately 225,000. Sampling surveys were made to determine the bacteriological quality of the influent and effluent waters from the following paper mills:

Consolidated Paper Company - North Side

Division.

Consolidated Paper Company - South Side Division.

Monroe Paper Products Company.

Union Bag-Camp Company - River Raisin Division.

The results of these surveys are tabulated separately in Table 29-VI.

(Tables 28-VI and 29-VI follow.)

TABLE 28-VI. RESULTS OF BACTERIOLOGICAL INVESTIGATION OF OVERFLOW FROM STORM PUMPING STATIONS NEAR STERLING STATE PARK

Date	Sta.*	Total Coliform Organisms/100ml	Fecal Coliform Organisms/100ml	Fecal Strep Organisms/100ml
1964				
3/25	P1	780,000	39,000	18,000
	P3	160,000	24,000	29,000
	P5	740,000	37,000	48,000
4/6	P5	107,000	5,300	220
4/7	P5	54,000	5,400	1,000
4/13	P5	6,000	-	210
4/21	P5	86,000	4,300	11,840
4/23	P5	116,000	17,400	5,960
4/29	P1	410,000	20,500	48,000
	P2	170,000	17,000	41,200
	P5	63,000	3,150	9,400
5/7	P3	490,000	49,000	1,730
5/8	P3	400,000	40,000	44,800

* See Figure 19-VI

TABLE 29-VI. SUMMARY OF BACTERIOLOGICAL INVESTIGATION OF INDUSTRIAL WASTE SOURCES NEAR STERLING STATE PARK. APRIL - MAY, 1964

Industry	Geometric Mean Densities			
	Estimated Discharge (MGD)	Total Coliforms Org/100ml	Fecal Coliforms Org/100ml	Fecal Strep Org/100ml
Effluent				
Consolidated Paper Co.				
South Plant	7.0	219,000	17,600	630
North Plant	1.0	215,000	42,300	5,520
Monroe Paper Products	2.2	3,370,000	730,000	5,630
Mason Run (Consolidated North & Union Bag)	11.0	98,000	18,000	1,040
Weighted Mean Effluent Samples	21.2 (total)	484,000	92,800	1,570
Influent				
Consolidated Paper Co.	-	14,600	1,800	56
Monroe Paper Products	-	1,570	100	80

Richard D. Vaughan

HYDROLOGIC FACTORS INFLUENCING WATER QUALITY

a. Currents.

Current observations were made at three points along Sterling State Park beach in April and May, 1964. Dye was placed in the water at a depth of about 2 feet and its direction and velocity of movement observed on 14 different days under a variety of wind conditions.

The direction of water movement is influenced primarily by wind friction, but is modified in direction and velocity at the inshore areas along the beach. Sterling State Park has a typical sandy beach with constantly changing bar patterns running in random fashion both parallel and perpendicular to the shoreline. At each end of the beach a pier extends into the lake about 200 feet, deflecting current movements somewhat. Seiche action on Lake Erie is practically continuous, and when the surface level is changing the water near the shore shows considerable movement shoreward or lakeward.

Nevertheless, except in the case of easterly winds, the general pattern of flow was evident from the inshore stations studied. (Winds from easterly quadrants cause onshore water movement, resulting in variable flow, and no distinct patterns of northward or southward alongshore currents.)

In order to expand the survey data to give an indication of the per cent of time that various currents could be expected, a comparison was made with long-term wind data. The nearest available station record is from Grosse Ile, as shown in U. S. Weather Bureau Technical Paper 35, "Climatology and Weather Services, Great Lakes and St. Lawrence Seaway." The general trend of current movements and related winds observed during the survey in April and May 1964 was compared to the winds recorded on a monthly and annual basis in the U.S. Weather Bureau publication.

For the 10-month ice-free period (March through December) the water could be expected to move along the beach in a northerly direction about 45 per cent of the time; in a southerly direction about 20 per cent of the time; and be variable and unpredictable about 35 per cent of the time.

In June, July, and August, when beach use is maximum, northerly currents can be expected about 40 per cent of the time; southerly currents about 15 per cent of the time; and variable and unpredictable currents about 45 per cent of the time, including about 15 per cent of the time when calm conditions prevail.

Water movements, in a northerly direction create a potential problem from Raisin River water, and in a southerly direction a potential problem from storm pumps, tributaries, and other sources to the north of the Park. Variable movements involve hazards from either direction. Whether or not the problem condition materializes depends on other factors such as rainfall, runoff, and seiche action which introduce the pollutant into the moving mass of Lake water.

b. Rainfall has an effect on three potential sources of pollution in the Sterling State Park area. These are:

(1) The stormwater pumps from the Detroit-Woodland Beach areas;

(2) Sandy Creek;

(3) The Raisin River.

These sources are discussed individually and jointly and sampling results during periods of rainfall given.

Bacteriological results from random samples taken at stormwater pumping stations during the 1964 survey show that they are definitely potential sources of coliforms. Coliform counts as high as 780,000 per 100 ml were found at the Woodland Beach pumping station during the storm of March 25 when 1.55 inches fell at the Toledo Airport. With the possible exception of the stormwater pumping station located on the southern edge of Detroit Beach, pump sites were usually dormant except during periods of rain.

Sandy Creek contains relatively high coliform counts during periods of high runoff. The highest flow recorded in the Creek during the survey was about 60 cfs on April 29, after thundershowers had passed through the area, compared to a monthly dry weather flow of approximately 5 cfs. The coliform count in the Creek on April 29 was 24,000 per 100 ml. Another period of relatively high runoff occurred on May 8, when the flow reached about 20 cfs and the coliform count was 77,000 per 100 ml.

The Raisin River is grossly polluted at all times, but its highest coliform counts occurred after the rain of May 8, reaching 470,000 per 100 ml. The Raisin River also receives a significant load of pollution from stormwater overflows, discussed specifically in the section on the Raisin River.

During the 1964 survey, the first rainfall occurred on April 21. Samples were collected the day of the rain as well as on the preceding and following days. The coliform counts at Detroit Beach, most affected by stormwater pumping, increased from a high count of 10,000 per 100 ml on the day before the rain to 14,000 per 100 ml on the day of the rain.

The next two days' counts showed a drop of about 50 percent each day. The Sterling State Park sampling station closest to Detroit Beach showed a decrease in coliform count during the day of the rain with a slight increase on the following day, and then a further decrease on the next day. Currents at the mouth of Sandy Creek were upstream, and because of this, the potential effects on the Park of bacterial pollution from the Detroit-Woodland Beach area were probably lessened, some of the polluted Lake water being drawn into the creek.

Rain fell again on April 27, 28, 29, and 30.

On April 29 there were coliform counts of 14,000 per 100 ml at Detroit Beach just north of the mouth of Sandy Creek; and 10,000 per 100 ml at Sterling State Park just south of Sandy Creek.

The flow in Sandy Creek was 60 cfs on April 29. The direction of flow at the mouth of the creek was not determined at this time, but it was probably lakeward, with a runoff so large. Currents off the Park were

Richard D. Vaughan

northerly and would tend to move effluent from Sandy Creek northward toward Detroit Beach.

A thunderstorm passed through the area early on May 8. Samples taken on this day show high coliform counts on all beach stations, decreasing in magnitude at stations farther from the mouth of the Raisin River. The coliform count at Detroit Beach on this date was 47,000 per 100 ml, only exceeded on one other occasion during the survey. Since the Lake currents were northerly and because the direction of flow from Sandy Creek was not noted, it is impossible to know if the high count was due to pollution from Sandy Creek or the Raisin River.

In general, Sandy Creek and the Detroit-Woodland Beach pump houses are sources of pollution following rain, while the Raisin River is a more constant polluter of the beaches. If the Lake currents opposite the beaches are northerly, as during the rains on April 29 and May 8, pollution from the first sources is probably swept northward having little effect on the Park. In this event, the Raisin River almost certainly contributes waste to the Park waters. If the current is southerly and Sandy Creek flows lakewards, the pollution from the Detroit-Woodland Beach area and the Creek would be sufficient to cause serious contamination of the waters off Sterling State Park, even without the effect of the Raisin River.

Summary of Findings

1. The water quality at the beaches in the Brest Bay area is primarily affected by local sources of pollution rather than by the Detroit River.

2. The Raisin River is the primary cause of pollution at Sterling State Park beach.

3. Wind-driven water currents can be expected to move along the Park beach in a northerly direction 45 percent of the time, in a southerly direction 20 percent of the time, and variably and unpredictably about 35 percent of the time. When water currents move along the beach in a northerly direction the effect of the Raisin River is predominant at the Park. When the currents move in a southerly direction, overflow from stormwater pumping stations, polluted tributaries, and shorefront houses north of Sterling State Park have the predominant effect on water quality at the beach.

4. The Raisin River is bacteriologically polluted throughout the year, the primary sources of this contamination being the four paper mills in Monroe and the Monroe Sewage Treatment Plant. Industrial sources

contribute most of the bacteria during summer months, when the municipal effluent is chlorinated (June through September), and the municipal plant is the leading contributor during the remainder of the year.

5. Septic tank effluents enter Lake Erie to a limited extent directly from waterfront houses north of the Park, and to a much greater extent indirectly from drainage ditches and stormwater collection systems. Discharges occur primarily during periods of heavy rainfall and runoff.

6. Stormwater runoff itself often contains high densities of coliform, and discharge of stormwater to the Lake or its tributaries creates a health hazard when currents carry this contaminated water to beach areas.

7. Discharge from Sandy Creek threatens water quality at the north end of the Park. Because of the reverse flow in the Creek at its mouth due to water withdrawal by several major industries, the effect of these discharges on the Park is felt only during periods of high runoff or during rapid fall of the Lake water level.

8. Waste discharges from Stony Creek and above, including a small nearby boat inlet, carry high coliform densities, but the volume of flow is small.

Because of the prevailing currents, these sources probably affect water quality on local beaches rather than at Sterling State Park.

9. Water quality at the Lake sampling stations opposite Brest Bay was generally satisfactory for swimming, while beach water at Sterling State Park is erratically affected by coliform counts too high to permit safe swimming.

MAPLE-MILLEVILLE BEACH SURVEYS

A special study was made September 3 - 5, 1963, to determine the influence of the Trenton Channel upon water quality at the Maple and Milleville bathing beaches, located near the mouth of the Detroit River and designated as regular stations B1 and B2 (see Figures 2-I and 3-I.

These are the findings:

1. Water adjacent to Maple and Milleville beaches is unsafe for swimming, with coliform values during the three-day survey ranging from 600 to 2,600 organisms per 100 ml and fecal coliform values ranging from 20 to 800 organisms per 100 ml. The geometric mean coliform density at these beaches during the Project was 2,000 organisms per 100 ml.

Richard D. Vaughan

2. Water quality adjacent to the two beaches is of much higher bacterial quality than water farther offshore. The same phenomenon is demonstrated by comparison of Estral, Dewey, and Stony Point Beaches and adjacent Lake Erie bacteriological results (geometric means for the duration of the Project).

In this case the beach samples are approximately 25 per cent of the magnitude of the adjacent lake stations. The beach and Lake stations are shown in Figure 2-I as numbers B3, B4, L3, L5, L6, and L7. (In the Lake Erie bathing beaches from Stony Point south to the Michigan-Ohio state line coliform densities adjacent to the beaches were higher than at corresponding Lake stations.)

3. The Detroit River is the main influence on bacterial water quality at bathing beaches from the mouth of the River to Stony Point. Below this point direct pollution and other tributaries have the greater influence on bacteriological water quality.

ROOTED AQUATIC VEGETATION STUDY

Rooted aquatic vegetation was abundant during the summer of 1964 along the shoreline of Grosse Ile in the Detroit River and Lake Erie. Growths were prolific this year primarily due to low water levels; the waters near the shore are shallower, allowing greater light penetration to stimulate growth. Warmer summer temperatures and a ready supply of essential plant nutrients (soluble phosphorus and inorganic nitrogen) from waste discharges in the adjacent waters or bottom muds also contribute to this problem.

Two genera of rooted aquatic vegetation were observed - Potamogeton and Vallisneria-- and intertwined among these rooted aquatics were growths of the attached green algae, Cladophora and Hydrodictyon. These growths are not only undesirable from an aesthetic standpoint, but also interfere with boating by fouling propellors. Later in the season the vegetation dies and decomposes, accompanied by strong odors.

The phenomenon was surveyed only in the last months of Project operation and not incorporated into the section on biology. Solutions to the problem include abatement of pollution from sources containing significant amounts of phosphorus and nitrogen compounds.

INTERFERENCES WITH WATER USES

Municipal Water Supply

Monroe is currently the only city taking municipal water from the Michigan waters of Lake Erie.

Algal growths in Lake Erie have caused serious taste and odor problems in the public water supply of the City of Monroe, and in 1950 forced the Monroe waterworks to move its intake point in a attempt to obtain purer drinking water. Algal blooms are now observable at the new water intake, and portend a renewal of taste and odor problems in the near future. Algal growth is conditioned by the high levels of inorganic nitrogen compounds and soluble phosphates discharged to the Lake from the Detroit and Raisin Rivers.

High ammonia concentrations at the Monroe water intake interfere with disinfection, and require the addition of excessive amounts of chlorine so that bacteria do not survive in drinking water.

Chloride concentrations at the Monroe water intake have increased from an average of 30 mg/1 to 40 mg/1 in the past four years. These chlorides originate primarily in the calcium chloride and lime wastes discharged from soda ash plants on the Detroit River. These wastes have increased hardness in the Monroe water supply by 25 per cent, necessitating increased use of detergents for household cleaning.

INDUSTRIAL WATER SUPPLY

Pollution of the Raisin River has become so complete that its lower few miles are offensive to sight and smell, and undesirable as a source of industrial water supply. Rising chloride levels indicate potential problems with corrosion of industrial equipment.

RECREATION

Damages to recreational opportunities in Lake Erie and its Michigan tributaries may be the worst effects of pollution, inestimable in dollar figures. At beaches near the mouth of the Detroit River, any kind of water contact sports--even water skiing or boating--is hazardous. The beaches at Sterling State Park, in heavy demand by a metropolitan population of nearly four million (projected to reach 5½ million by 1980) have had to be closed due to bacteriological contamination. The land area near the beaches is often offensive due to the washing ashore and depositing of sewage and industrial debris, often in an advanced state of decomposition. Even far away from shore spills of oil from boats, floating slicks of pollution, and turbidity due to heavy concentrations of microscopic life have destroyed the beauty of the Lake.

FISH AND WILDLIFE PROPAGATION

Deposits of sewage and industrial sludge on the bottom of Lake Erie and its tributaries in Michigan threaten to destroy the food and habitat that make life possible for any but tough, inedible species of fish. Large areas of the bottom of Michigan Lake Erie are already inhabited only by pollution tolerant organisms such as leeches and sludgeworms. Acute fish kills have been caused by discharges of oil and other toxic industrial wastes. In 1960 a heavy discharge of untreated waste slaughtered 10,000-12,000 ducks, or 50 percent of the wild fowl population of the area.

Heavy algal blooms and the spread of slime bacteria over large areas of the Lake in Michigan represents still another danger to aquatic life. These growths and the nutrients which feed them consume large quantities of the dissolved oxygen, without which fish can neither propagate nor live. They also add to the turbidity of the water, depriving fish of needed light.

NAVIGATION

Sludge deposits at the mouth of the Raisin, Detroit, and other rivers tributary to the Lake require expensive annual dredging by the U. S. Army Corps of Engineers in order to preserve routine navigability.

EUTROPHICATION OF THE LAKE

The natural aging of a stagnant body of water (such as Lake Erie), its gradual enrichment with many varieties of plant and animal life and their deposits, is being accelerated by the discharges of nutrients and organic wastes into Lake Erie. If these discharges are not halted turbidity in the Lake may increase until it becomes unusable for most purposes.

SECTION VII

BIBLIOGRAPHY

DETROIT RIVER-LAKE ERIE PROJECT

"A Report on the Water Supply for the Six-County Metropolitan Area, Southeastern Michigan." 1957. Six-County Study Commission.

"A Study of Organic Contaminants in Boundary Waters using Carbon Filter Techniques, Lake Huron - Lake Erie." Prepared for the International Joint Commission, United States and Canada, 1953-1955.

"Algae and Metropolitan Wastes." Transactions of Seminar, Robert A. Taft, Sanitary Engineering Center, United States Department of Health, Education & Welfare, Public Health Service, 1960.

Allport, N. L, and Keyser, J. W., "Colorimetric Analysis Volume I. Determination of Clinical and Biochemical Significance." Chapman and Hall, Ltd., Publishers, 2nd Edition, 1957.

"An Evaluation of the Urban Renewal Program in Detroit, Renewal Revenue." A demonstration grant study by the Detroit City Planning Commission, cooperating with the Housing & Home Finance Agency.

Richard D. Vaughan

"An Industrial Waste Guide to the Meat Industry." United States Department of Health, Education, & Welfare, Public Health Service; 1954.

Annual Operating Report of the Department of Water Supply, City of Detroit.

Annual Reports, City of Wyandotte Department of Municipal Service.

Anon, ORSANCO'S 10th Annual Report. Membrane Filger Adopted. Water & Sewage Works; 103:3:140-141, Mar. 1959.

"Aquatic Biology in Water Pollution." Course Manual, Water Supply and Pollution Control Training, Robert A. Taft, Sanitary Engineering Center, U. S. Department of Health, Education & Welfare, Public Health Service, 1957.

"Aquatic Life Water Quality Criteria." 1st Progress Report, Ohio River Valley Water Sanitary Commission, Sewage and Industrial Wastes, March, 1955.

"Aquatic Life Water Quality Criteria, 2nd Progress Report, Ohio River Valley Water Sanitation Commission, Sewage and Industrial Wastes; May, 1956.

Aquatic Life Water Quality Criteria, 3rd Progress Report, Ohio River Valley Water Sanitation Commission, Journal Water Pollution Control Federation, January, 1960.

Arden, Bruce W. "An Introduction to Digital Computing." Addison-Wesley Publishing Company, Incorporated.

Babbitt, Harold E., and Baumann, E. Robert, "Sewerage and Sewage Treatment." John Wiley and Sons, Incorporated, New York, 8th Edition, 1952.

Baltz, David F. "Colorimetric Determination of Non-Metals." Interscience Publishers, Incorporated, 1946.

Baltz, David, "Colorimetric Determination of Non-Metals." Interscience Publishers Incorporated, New York, 1958.

Bartsch, Alfred F. and Ingram, William M. "Stream Life and the Pollution Environment." Public Works.

Benedict, I. J. "Membrane Filter Technique." Water & Sewage Works, 108, Feb. 1961.

"Bergey's Manual of Determinative Bacteriology." Williams and Wilkins, Publishers, 7th Edition, 1957.

Berjes, H. H. "Storm Water Overflows from Combined Sewers." Journal Water Pollution Control Federation, December, 1961.

"Bioassy and Pollution Ecology." Course Manual, Water Supply and Pollution Control Training, Robert A.

Richard D. Vaughan

Taft Sanitary Engineering Center, U. S. Department of Health, Education & Welfare, Public Health Service, 1958.

Black and Veatch, "A Report on Waste Disposal and Water Use in the Downstream Portions of the Huron River." 1960.

Boog, Allen, and Hamilton, Incorporated, "Riverfront Study, Phase I, Summary, Economic Survey, and Master Plant of Port, Development, Port of Detroit." May, 1963.

Breed, Charles B., and Hasmer, George L., "The Principles and Practice of Surveying, Volume II, Higher Surveying." John Wiley and Sons, Incorporated, New York, 5th Edition, 1940.

Brunsman, J. J. et al., "Improved Oil Separation in Gravity Separators." Journal Water Pollution Control Federation, 1962.

Buttiaux, R., Surveillance et Controle Des Eaux D'Alimentation III. La Standardisation des Methodes d'Analyse Bacteriologique de l'Eau. Revue d'Hygiene et de Medicine Sociale, Tome 6, No. 2, 170-192; 1958.

Camp, Thomas R., "Overflows of Sanitary Sewage from Combined Sewerage Systems." Sewage and Industrial Wastes, April, 1959.

Center of Population, Detroit Metropolitan

Area and City of Detroit 1930-1960." April, 1961, Department of Sociology and Anthropology, Wayne State University, Detroit Metropolitan Area Regional Planning Commission.

Chanin, G., et al, "Use of Glass Fiver Filter Medium in the Suspended Solids Determination." Sewage and Industrial Wastes, August 1958.

"Chemical Analysis for Water Quality," Course Manual, Water Supply and Pollution Control Training, Robert A. Taft Sanitary Engineering Center, U. S. Department of Health, Education, and Welfare, Public Health Service, 1959.

Clarke, Norman A., et al, "Removal of Enteric Viruses from Sewage by Activated Sludge Treatment." American Journal of Public Health, August, 1961.

Clarke, Norman A. and Kabler, Paul W., "Human Enteric Viruses in Sewage." Health Laboratory Science, 1:44, January, 1964.

"Coliform Standards for Recreational Waters." Progress Report, Public Health Activities Committee, Sanitary Engineering Division, American Society of Civil Engineers, August, 1963, and Discussion by John H. Ruskin, April, 1964.

Richard D. Vaughan "Comprehensive Study on Protection of Water Resources of Lake Tahoe Basin through Controlled Waste Disposal." June, 1963, Engineering-Science, Inc.

Cornwell, George, et al. "Superparasitism as a Suspected Factor in Winter Waterfowl Mortality on the Lower Detroit River." Presented at the Midwest Fish and Wildlife Conference, December 5-7, 1960, at Toronto, Ontario.

Daniels, Farrington, et al, "Experimental Physical Chemistry." McGraw-Hill Book Company, Incorporated, New York, 3rd Edition, 1941.

Davis, Charles C., "Evidence for the Eutrophication of Lake Erie from Phytoplankton Records." Limnology and Oceanography, 9:275, July, 1964.

"Detroit River, Trenton Channel Michigan Navigation Project." U. S. Army Engineers District, Detroit, Corps of Engineers, Detroit, Michigan, December, 1961.

Detroit's Water Development Program for the Metropolitan Area, 1959.

"Digest of Water Pollution Control Legislation, Michigan." U. S. Department of Health, Education & Welfare, Public Health Service, September, 1958.

Direct Testimony of Gordon M. Fair, Illinois River-Lake Michigan Diversion Hearings, Chicago, Illinois, 1963.

Dobbs, R. A., and Williams, R. T., "Elimination of Chloride Interference in the Chemical Oxygen Demand Test." Analytical Chemistry, July, 1963.

"Drought Flows of Michigan Streams." Department of Environmental Health School of Public Health, University of Michigan, in Cooperation with Michigan Water Resources Commission, 1960.

"Ecology of Water Pollution." Course Manual, Water Supply and Pollution Control Training, Robert A. Taft Sanitary Engineering Center, U. S. Department of Health, Education and Welfare, Public Health Service, 1958.

"Economy of the Detroit Area." Detroit Metropolitan Area Regional Planning Commission, January, 1960.

Ernest, G E. "The Bacteriological Examination of Water with the Membrane Filter Versus Standard Method." J. Amer. Med. Tech., pp. 225-227, June, 1963.

"Exploration of Collateral Data Potentially Applicable to Great Lakes Hydrography and Fisheries, Phase II." Great Lakes Research Institute, University of Michigan, 1959.

Fair, Gordon M., and Geyer, John C., "Water Supply and Waste Water Disposal." John Wiley and Sons, Incorporated, New York.

Frey, David G., "Limnology in North America." University of Wisconsin Press, Madison, Wisconsin, 1963.

Geldreich, E. E., et al, "Type Distribution of Coliform Bacteria in the Feces of Warm-blooded Animals." Journal Water Pollution Control Federation, 34:295, March, 1962.

Giles, R. N., et al, "Performance of a Gravity-Type Oil-Water Separator on Petroleum Refinery Wastes." Sewage and Industrial Wastes, March, 1951.

Glass, Andrew C. and Jenkins, Kenneth H., "Statistical Summary of 1962 Inventory Municipal Waste Facilities," U. S. Department of Health, Education & Welfare, Public Health Service.

"Great Lakes Pilot." U. S. Lake Survey, Corps of Engineers, U. S. Army, 1963.

Gurnham, C. Fred, "Principles of Industrial Waste Treatment." John Wiley and Sons, Incorporated, New York, 1955.

Richard D. Vaughan

Gustafson, H., and Behrman, A. S., "Determination of Total Dissolved Solids in Water by Electrical Conductivity." Industrial Engineering Chemistry, Analytical Ed. Vol. 11, 1939.

Hamilton, Leicester F., and Simpson, Stephen G., "Calculations of Analytical Chemistry." McGraw-Hill Book Company, Inc., New York, 5th Edition, 1954.

Hawk, P. B., et al, "Practical Physiological Chemistry." Blakiston Company, Incorporated, Publishers, 13th Edition, 1954.

"Hazen, Richard, and Sawyer, A. W., "Report to Board of County Road Commissioners, Wayne County, Michigan, on Additional Water Supply for Wayne County." 1955.

Hazey, G. "An Operator's Viewpoint on the Membrane Filter Technique." The Emer. City, 73:11:116-118, Nov., 1958.

Henderson, W. L. "Studies on the Use of Membrane Filter Technique, for Use of Estimation of Coliform Densities in Sea Water." Sewage & Ind. Wastes, 31:1:78-91, Jan., 1959.

Heukelekian, H., and Day, Robert V., "Disinfection of Sewage with Chlorine, III. Factors affecting Coliforms Remaining and Correlation of Ortho-

Tolidine and Amperometric Chlorine Residuals." Sewage and Industrial Wastes, February, 1951.

Heukelekian, H., and Faust, S. D. "Compatibility of Wastewater Disinfection by Chlorination." Journal Water Pollution Control Federation, 33:932, September, 1961.

Hoffman, D. A., et al, "A Comparison of Membrane Filter Counts and Most Brobable Numbers of Coliform in San Diego's Sewage and Receiving Waters." Journal Water Pollution Control Federation, 36:109-117, January, 1964.

Hohn, M. H., "Determining the Pattern of Diatom Flora." Journal Water Pollution Control Federation, January, 1961.

"Home Survey of Regional Recreation Activities, Part III, Recreation in the Detroit Region." Detroit Metropolitan Area Regional Planning Commission, January, 1960.

Hunt, George S., and Ewing, Howard E., "Industrial Pollution and Michigan Waterfowl." Transactions of the 18th North American Wildlife Conference, March 9, 1953.

Hunt, George S.and Cowan, Archibald B., "Causes of Deaths of Waterfowl on the Lower Detroit

River, Winter, 1960." North American Wildlife Conference, March 9, 1953.

Huron River Watershed Intergovernmental Committee; annual report, 1960, 1961.

Hyman, Libbe, "The Invertebrates: Protozoa through Ctenophora." McGraw-Hill Book Company, New York, 1940.

Hynes, H. B. N., "Interpretation of Biological Data with Reference to Water Quality." Symposium on Environmental Measurements, Cincinnati, Ohio, Septembef, 1963.

Ingram, William M. and Towne, W. W., "Stream Life Below Industrial Outfalls." Proceedings of the 14th Purdue Industrial Waste Conference, 1959.

Ingram, William M. , and Towne,W. W., "Effects of Industrial Wastes on Stream Life." Purdue University Engineering Bulletin, Volume XLIV, Number 5, September, 1960.

Ingram, William M., and Bartsch, A. F., "Graphical Expression of Biological Data in Water Pollution Reports." Journal Water Pollution Control Federation, March, 1960.

"Inorganic Industrial Wastes Characterization." Course Manual, Water Supply and Pollution Control

Training, Robert A. Taft Sanitary Engineering Center, U. S. Department of Health, Education & Welfare, Public Health Service, 1960.

International Joint Commission, Detroit Field Unit, Six-Month Progress Reports.

Jeffers, Karl B., "Hydrographic Manual." Publication Number 20-2, U. S. Department of Commerce, Coast and Geodetic Survey, 1960.

Johnson C. Frank, "Equipment,Methods, and Results from Washington, D. C. Combined Sewer Overflow Studies." Journal Water Pollution Control Federation, July, 1961.

Johnson, E. E., "Millipore Filter Procedures: New, Approved Method of Water Analysis." Johnson Drillers Journal; 35:1:1-3, Jan. - Feb., 1963.

Johnson, W. K., "Nutrient Removals by Convertional Treatment Processes." Proceedings of the 13th Purdue Industrial Waste Conference, 43:151, September, 1959.

Johnson, Walter K., and Schroepfer, George J., "Nitrogen Removal by Nitrification and Denitrification." Journal Water Pollution Control Federation, 36:1015, August, 1959.

Kabler, Paul W., "Removal of Pathogenic Microorganisms by Sewage Treatment Processes." Sewage and Industrial Wastes, December, 1959.

Kelly, Sally, and Sanderson, Wallace W., "Density of Enteroviruses in Sewage." Journal Water Pollution Control Federation, 32:1269, December, 1960.

Kelly, Sally, and Sanderson, Wallace W., "The Effect of Sewage Treatment on Viruses." Sewage and Industrial Wastes, 31:683, June, 1959.

Kelly, Sally, et al, "Removal of Enteroviruses from Sewage by Activated Sludge." Journal Water Pollution Control Federation, 33:1056, October, 1961.

King, Horace, W., "Handbook of Hydraulics," McGraw-Hill Book Company, Incorporated, New York, 4th Edition, 1954.

Kittrell, F. W., and Furfari, Santo A., "Observations of Coliform Bacteria in Streams." Journal Water Pollution Control Federation, November, 1963.

Klein, Louis, "River Pollution I. Chemical Analysis." Academic Press Incorporated, Publishers, New York, 1957.

Klein, Louis, "River Pollution II. Causes and Effects." Butterworth and Company, Limited, Publishers, London, 1962.

Kruse, J., and Mellon, M. G., "Colorimetric Determination of Free Ammonia with a Pyridine-Pyrazolone Reagent." Sewage and Industrial Wastes, September, 1952.

Lagler, Karl F., "Freshwater Fishery Biology." William C. Brown Company, Publishers, 1961.

Laitinen, H. A., "Chemical Analysis." McGraw-Hill Company, Inc., New York, 1960.

"Lake Erie Drainage Basin." A cooperative State-Federal Report on Water Pollution, Federal Security Agency, Public Health Service, 1951.

"Lake Erie Pollution Survey," State of Ohio, Department of Natural Resources Division, April, 1953,

"Langlois, Thomas H. The Western End of Lake Erie and its Ecology." J. W. Edwards Publisher, 1954.

Large, Norbert A. "Handbook of Chemistry." Handbook Publishers, Incorporated, 1946.

Laubusch, E. J. "MPN Coliform Index." Water and Sewage Works, 105:8:334 - 338, Aug., 1958.

Lewis, Harry F., "Laboratory Planning for Chemistry and Chemical Engineering." Reinhold Publishing Corporation, New York, 1962.

"Limnological Survey of Eastern and Central Lake Erie, 1928-1929." Special Scientific Report Fisheries No. 334 U. S. Department of the Interior, Fish and Wildlife Service, June, 1960.

"Limnological Survey of Western Lake Erie," Special Scientific Report - Fisheries Number 139, U. S. Department of Interior, Fish and Wildlife Service.

Lindgren, B. W., and McElrath, G. W., "Introduction to Probability and Statistics." Macmillan Company.

"List of Lights and Other marine Aids." Voume IV Great Lakes, United States and Canada, 1963.

Ludzack, F. J., and Ettinger, M. B., "Controlling Operation to Minimize Activated Sludge Effluent Nitrogen." Journal Water Pollution Control Federation, 34:920, September, 1962.

Mackenthun, Kenneth M., "A Review of Algae, Lake Weeds, and Nutrients." Journal Water Pollution Control Federation, 34:1133, November, 1962.

Mack, W. N. et al, "Isolation of Enteric Viruses and Salmonellae from Sewage. 1. Comparison of Coliform and Enterococci Incidence to the Isolation of Viruses." Sewage and Industrial Wastes, 30:957, August, 1958.

McNabb, C. D., Presented at the Sixth Annual Meeting of the Midwest Benthological Society, Madison, Wisconsin, April 17, 1958.

"Manual on Disposal of Refinery Wastes." Volume I, American Petroleum Institute, New York, 1959.

"Manual on Industrial Water and Industrial Waste Water." Prepared by American Society of Testing Materials Committee D-19 on Industrial Water, 2nd Edition, 1959.

Marks, William D., "Michigan and the Great Lakes." Michigan Water Resources Commission, 1961.

Marks, William D., "Summary Review of Lake Erie Commercial Fish Catch Since Beginning of Record." Michigan Water Resources Commission, August 29, 1962.

McCarthy, J. A. et al, "Measuring Coliforms in Water." Water & Sewage Works, 108:238, 1961.

McKee, J. E., McLaughlin, R. T., "Application of Molecular Filter Techniques to the Bacterial Assay of Sewage. II. Experimental Results for Settled Sewage." Sewage & Ind. Wastes, 30:2:129-137, Feb., 1958.

"Michigan Algorithmic Decoder." A Manual, University of Michigan, January, 1963.

Miller,James F., "Park Users Survey. A Survey of Persons Using Eight Selected Regional Parks in the Detroit Region." Detroit Metropolitan Area Regional Planning Commission.

Miller, Herbert J., and Whitlock. S. C., "Detroit River Waterfowl Mortality. Winter, 1948." Game Division, Michigan Department of Conservation, April, 1948.

Milton, R. F. and Waters, W. A., "Methods of Quantitative Micro Analysis," Edward Arnold, Limited, Publishers, London, 1955.

Moorehead, George J., "Overflows from Combined Swewers in Washington, D. C." Journal Water Pollution Control Federation, July, 1961.

Muenscher, Walter C., "Aquatic Plants of the United States." Comstock Publishing Company, 1944.

Mullmann, W. L. and F. R. Peabody, "Multiple Tube Dilution and Membrane Filter Methods." Water & Sewage Works, 108:384-389: 1961.

National Water Quality Network, Annual Compilation of Data. United States Department of Health, Education, and Welfare, Public Health Service.

Nemerow, Nelson L., "Theories and Practices of Industrial Waste Treatment." Addison-Wesley Publishing Company, Inc., 1963.

"1962 Residential Construction in the Detroit Region." Detroit Metropolitan Area Regional Planning Commission, January, 1963.

"1962 Shopping Centers in the Detroit Region." Detroit Metropolitan Area Regional Planning Commission.

"1970 and 1980 Population Projections, Detroit Region." Population and Housing Committee. Detroit Metropolitan Area Regional Planning Commission, February, 1963.

"Off-Rail Industrial Lands Plan for the Detroit Region." Detroit Metropolitan Area Regional Planning Commission, October, 1961.

"Ohio River Pollution Control." Report of the United States Public Health Service in two Parts, August 27, 1943.

"Organic Industrial Wastes Characterization." Course Manual, Water Supply and Pollution Control Training. Robert A. Taft Sanitary Engineering Center, U. S. Department of Health, Education, and Welfare, Public Health Service, 1960.

"Outdoor Recreation for America." A report to the President and to the Congress by the Outdoor Recreation Resources Review Commission.

Palmer, Clyde L. "The Pollutional Effects of Storm Water Overflows from Combined Sewers." Sewage and Industrial Wastes, February, 1950.

Palmer, Clyde L., "Feasibility of Combined Sewer Systems." Journal Water Pollution Control Federation, February, 1963.

Palmer, C. M., "Algae in Water Supplies." Robert A. Taft Sanitary Engineering Center, United States Department of Health, Education, and Welfare, Public Health Service, 1959.

Pennak, Robert W., "Fresh-Water Invertebrates to the United States." Ronald Press Company, 1953.

Petrilli, F. L. and G. Agnese. "On the Accuracy of the Methods Employed for Detecting the Coliform Bacteria in Water and for Calculating the Microbial Density in General." Boll, lst, Sieroterap. Milan. 39 (1/2) 74-86: 1960.

Phelps, Earle B., "Stream Sanitation." John Wiley and Sons, Incorporated, New York.

"Plankton Identification and Control." Course Manual, Water Supply and Pollution Control Training Robert A. Taft Sanitary Engineering Center, U. S. Department of Health, Education, and Welfare, Public Health Service, 1958.

Prescott, G. W., "Algae of the Western Great Lakes Area." William C. Brown Company, Publishers, Revised Edition, 1962.

Prescott, Samuel C., et al, "Water Bacteriology." John Wiley and Sons, Incorporated, 6th Edition, 1946.

"Proceedings of the Conference on Great Lakes Research," Great Lakes Research Division, Institute of Science and Technology, University of Michigan, Ann Arbor.

Public Health Service Drinking Water Standards, United States Department of Health, Education, &Welfare, Public Health Service, 1962.

"Recent Developments in Water Bacteriology." Course Manual, Water Supply and Pollution Control Training, Robert A. Taft Sanitary Engineering Center, U. S. Department of Health, Education, & Welfare, Public Health Service, 1959.

Reference Manual, International Business Machines 1401 Data Processing System, 1962.

Reid, George W., et al, "Phenolic Wastes from Aircraft Maintenance." Journal Water Pollution Control Federation, 32:383, April, 1960.

"Report of the International Joint Commission, United States and Canada on the Pollution of

Boundary Waters." Washington-Ottawa, 1951.

"Report, Surveys, and Investigations of Agricultural Irrigation Potential in Huron River Basin." Huron River Watershed Intergovernmental Committee and United States Department of Agriculture, Soil Conservation Service, January, 1960.

Rider, B. F., and Mellon, M. G., "Colorimetric Determination of Nitrites." Analytical Chemistry, Volume 18, 1946, page 96.

Riegel, Emil R., "Industrial Chemistry." Reinhold Publishing Company, 4th Edition, 1942.

Romer, Harold, and Klashman, Lester M., "How Combined Sewers Affect Water Pollution." Public Works, March and April, 1963.

Rudolfs, Willem, "Industrial Wastes - Their Disposal and Treatment." Library of Engineering Classics, 1953.

"Safeguarding Boundary Water Quality." A Cooperative Effort between United States and Canada under International Treaty, 1961.

Sandell, E. B., "Colorimetric Methods of Analysis." Interscience Publishers Incorporated, 1958.

Sawyer, C. N., "Chemistry for Sanitary Engineers." McGraw-Hill Book Company, Inc., 1960.

Sawyer, C. N., "Fertilization of Lakes by Agricultural and Urban Drainage." Journ. New England Water Works Assn., vol. 61, No. 2, pp. 109-127; 1947.

Sawyer, C. N., "Factors Involved in Disposal of Sewage Effluents to Lakes." Sewage and Industrial Wastes, vol. 26, No. 3, pp. 317-325; 1954.

Sawyer, C. N., J. B. Lackey and R. T.Lens, "An Investigation of the Odor Nuisance Occurring in the Madison Lakes, Particularly Monona, Waubesa, and Kegonsa from July, 1942 - July, 1944." Report of Governor's Committee, Madison, Winsconsin, 2 vols.; 1945.

Sawyer, Clair N., "Some New Aspects of Phosphates in Relation to Lake Fertilization." Sewage and Industrial Wastes, 24:768. June, 1952.

Sawyer, Clair N., "Causes, Effects, and Control of Aquatic Growths." Journal Water Pollution Control Federation, 34:279; March, 1962.

Selleck, Robert E. and Pearson, Erman A., "Tracer Studies and Pollutional Analyses of Estuaries." Sanitary Engineering Research Laboratory College of Engineering and School of Public Health, University of California, Berkeley, July 29, 1960.

Sewage Treatment Plant Monthly Reports,

Board of Water Commissioners, Department of Water Supply, Detroit, Michigan.

Sheets, Waldron D., et al, "Microbiological Studies on the Treatment of Petroleum Refinery Phenolic Wastes." Sewage and Industrial Wastes, 26:862; July, 1954.

Slanetz, Lawrence W., and Bartley, Clara H., "Detection and Sanitary Significance of Fecal Streptococci in Water." American Journal of Public Health, 54:609; April, 1964.

"Smith's College Chemistry." Appleton Century Book Company, 3rd Edition.

Smith, Gilbert M., "The Fresh Water Algae of the United States." McGraw-Hill Book Company, Inc., New York, 2nd Edition, 1950.

Snedecor, George, "Statistical Methods." Iowa State University Press, Ames, Iowa, 5th Edition.

Southeastern Michigan Rain and Streamgage Committee, Annual Report, 1961.

Specht, R. C., "Disposal of Wastes from the Phosphate Industry." Journal Water Pollution Control Federation, 32:964; September, 1960.

Special Studies Dredging Operations Rouge River-Detroit River United States Corps of Engineers

Hopper Dredge Savannah, United States Public Health Service, Environmental Health Center, Cincinnati, Ohio.

"Special Surveys." Department of the Army Technical Manual TM5-235, October, 1953.

"Standard Methods for the Examination of Water and Wastewater." 11th Edition, 1960.

State of Michigan 1957 Report on Water Resource Conditions and Uses in the Huron River Basin, Michigan Water Resources Commission.

Stevenson, Albert H., "Studies of Bathing Water Quality and Health." American Journal of Public Health, 43:529; May, 1953.

Stones, T., "Iron and Phosphate Changes During Sewage Treatment." Sewage and Industrial Wastes, 31:981; August, 1959.

Streeter, H. W., Robertson, D. A., Jr., "Evaluation of Membrane Filter Technique for Appraising Ohio River Water Quality." Jour. AWWA, 52:2:229-246; February, 1960.

"Surface Water Records of Michigan." United States Geological Survey.

Supervisors Inter-County Committee. Fifth Annual Meeting Report; June, 1962.

Taguchi, Katsuhisa, "Experimental Studies on the Examination of Coliform Organisms in Water. II. "Application of the Membrane Filter Method." Bulletin of the Institute of Public Health (Japanese) 9, No. 4, 214-222; December, 1960.

Tarzwell, Clarence M., "Development of Water Quality Criteria for Aquatic Life." Journal Water Pollution Control Federation, November, 1962.

"The Changing Pattern of Manufacturing Plants and Employment 1950-1960 in the Detroit Region." Detroit Metropolitan Area Regional Planning Commission.

"The Ports of Detroit and Ports on the Saginaw River, Michigan." Port Series Number 45 Revised 1961, Part 2, Corps of Engineers, United States Army.

"Transcript of Conference in the Matter of Pollution of the Navigable Waters of the Detroit River and Lake Erie and their Tributaries within the State of Michigan." First Session, March 27-28; 1962; Detroit, Michigan.

United States Lakes Survey Charts Number 41, 412, 415, 416, 400, 3, 37, 29, 364, 374, 376. Corps of Engineers, United States Army.

Velz, Clarence J., and Gannon, John J., "Biological Extraction and Accumulation in Stream

Self-Purification." Journal Water Pollution Control Federation, March, 1962.

Walton, Graham, Effectiveness of Water Treatment Processes as Measured by Coliform Reduction: Part I - Water Treatment Plant Data; Part II - Special Cooperative MF-MPN Study. U. S. Department of Health, Education, & Welfare, R. A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Public Health Service; Pub. #898.

Ward, H. B., and Whipple, G. C., "Fresh-Water Biology." John Wiley and Sons, Incorporated, 2nd Edition, 1959.

"Waterborne Commerce of the United States, 1961; Part 3, Waterways and Harbors, Great Lakes." Corps of Engineers, United States Army.

"Water Quality Criteria." State Water Pollution Control Board, Sacramento, California, Publication No. 3; 1957.

"Water Quality Studies." Course Manual, Water Supply and Pollution Control Training, Robert A. Taft Sanitary Engineering Center, United States Department of Health, Education, and Welfare, Public Health Service, 1962.

"Water Service Priorities for the Detroit Region." Detroit Metropolitan Area Regional Planning

Commission, January, 1960.

Watts, H. L., "Colorimetric Determination of Large Amounts of Iron." Analytical Chemistry, February, 1964.

Weibel, S. R., et al, "Urban Land Runoff as a Factor in Stream Pollution." Robert A. Taft Sanitary Engineering Center, October, 1962.

Welsh, Paul S. "Limnology." McGraw-Hill Book Company, New York, 1952.

Welsh, Paul S., "Limnological Methods." McGraw-Hill Brook Company, Incorporated, New York, 1952.

"Western Great Lakes Drainage Basin." A Cooperative State-Federal Report on Water Pollution, Federal Security Agency, Public Health Service, 1951.

Wilcox, L. V, "Electrical Conductivity." Journal American Water Works Association, Volume 42, Page 775, 1950.

Wiley, John S., et al, "Enterovirus in Sewage during a poliomyelitus Epidemic." Journal Water Pollution Control Federation; 34:168, February, 1962.

Willard, H. H., et al, "Instrumental Methods of Analysis." Van Nostrand Company, Incorporated, New Jersey, 1958.

Willard, Hobart H., and Furman, N. Howell, "Elementary Quantitative Analysis, Theory and Practice." D. Van Nostrand Company, 3rd Edition, 1940.

Williams, Louis G., "Plankton Population Studies." Public Health Service Publication No. 663.

Wisler, C. O., "Water Resources of the Detroit Area, Michigan." Geological Survey Circular No. 183; 1952.

Woodward, Sherman A., and Posey, Chesley J., "Hydraulics of Steady Flow in Open Channels." John Wiley and Sons, Incorporated, New York, 1941.

MR. STEIN: All right.

MR. VAUGHAN: Continuing:

Interferences with Water Uses

Municipal Water Supply. Two municipal water intakes in the Detroit River, the Southwest City of Detroit intake and the Wyandotte intake, receive water with bacterial counts that pose a health hazard especially in the event that water treatment facilities should malfunction. Furthermore, ammonia levels at the Wyandotte intake are high enough to lessen the effectiveness of normal disinfection procedures, and phenols cause taste and odor problems.

Industrial Water Supply. The water supply of several industries is interfered with by high chloride concentrations in the Detroit River, but the Project staff was unable to obtain statements to this effect from the industries concerned.

Recreation. Pollution has necessitated that all beach areas on the Detroit River below Belle Isle be posted as unsafe for swimming and other water-contact sports. Thus 26 out of the 31 miles of the Detroit River have had their recreational usefulness greatly diminished. At the same time, many people ignore the warnings of State and local health authorities, and swim and water-ski in the restricted area. For these people, pollution in the River presents an immediate health hazard. Boaters and owners of marinas along the lower River are constantly harassed by oil slicks and sludge deposits, which deface boats and boat equipment, fill in and foul docking facilities, and create an aesthetic nuisance.

Fish and Wildlife Propagation. Creel census records indicate a change in the predominant types of fish in the Detroit River from a variety of desirable game fish to a predominance of carp and yellow perch. The destruction of 10,000-12,000 wildfowl in 1960 has been attributed to oil pollution.

Navigation. Sludge deposits at the junction of the Rouge and Detroit Rivers and at the mouth of the Detroit River require extensive annual dredging by the U. S. Army Corps of Engineers to maintain routine navigation.

This completes the summary of findings on the Detroit River. We will now proceed to the summary of findings on Lake Erie.

This study was limited to the Michigan waters of Lake Erie, which constitute approximately 1 percent of the surface area of this international body of water. Lake Erie is the shallowest of all the Great Lakes, and the greatest recorded depth in its Michigan waters is only 29 feet. Most of the water flowing into Lake Erie is from the Detroit River.

Description of Water Quality

The Michigan waters of Lake Erie have two major zones of pollution -- one in the vicinity of the mouth of the Detroit River, one near the mouth of the Raisin River. These waters are polluted bacteriologically, chemically, physically, and biologically; they contain excessive coliform densities, suspended solids, nitrates, ammonia, organic nitrogen and phosphates, and sludge deposits.

Bacterial Density. Sewage commonly contains many pathogenic organisms that can cause gastrointestinal diseases, eye, ear, nose and throat disorders, skin infections, and hepatitis when ingested. These organisms may include both bacteria and viruses. They are usually measured by counting the number of coliforms (and these are bacteria particularly associated with human or animal excreta).

The maximum density of coliform bacteria recommended in this report - 1,000 organisms per 100 ml. - is exceeded for 2 to 3 miles south of the mouth of the Detroit River and for approximately 1 mile out from the

Richard D. Vaughan

mouth of the Raisin River. Maximum coliform values showed a similar pattern of dispersion, with individual values exceeding 100,000 organisms per 100 ml. found near the mouths of the Raisin and Detroit Rivers. Fecal coliform densities ranged from 5 to 30 percent of the total, and geometric mean fecal streptococci were less than 80 per 100 ml. at all locations.

All bathing beaches along the Michigan shore of Lake Erie had geometric mean coliform densities of less than 1,000 organisms per 100 ml., except Maple Beach, located in the influence of the Detroit River. Geometric mean coliform densities at Sterling State Park beaches approached 1,000 organisms per 100 ml., but here relatively low means mask exceptionally high individual values which appeared under certain conditions of wind and weather, some exceeding 100,000 organisms per 100 ml. These maximums represent a hazard to health of water users. Fecal coliform and fecal streptococcus densities along the Lake Erie beaches were noticeably higher than in adjacent Lake waters.

Bacteriological densities in Lake Erie from the mouth of the Detroit River to a point 2 to 3 miles to the south are such that the water cannot safely be used for recreational purposes. Following heavy rainfall in the Detroit area, the zone of polluted water extends southward to Stony Point and outward from the Raisin River.

Dissolved Oxygen. Most of the Michigan waters of Lake Erie display high levels of dissolved oxygen. Two areas of low values were found near the mouths of the Detroit and Raisin River, with the more widespread effect radiating southward from the mouth of the Detroit River. In the immediate vicinity of the mouth of the Raisin River, complete depletion of oxygen was found, but within one-half mile into the Lake the levels recovered. Values as low as 4.8 mg/l and 58% saturation were found in the area south of the mouth of the Detroit River. Here the area of depressed values extends southwest 4 - 6 miles.

While present oxygen levels in the Lake do not yet cause major interferences with water use, the drop to 4.8 mg/l represents a threat to water uses in the Lake. Unless appropriate remedial action is taken now, the situation will almost certainly worsen.

Chlorides. Average chloride concentrations in the Michigan waters of Lake Erie ranged from 18 to 44 mg/l, with the higher values along shore and near the mouth of the Detroit River. Chlorides can interfere with domestic and industrial water use by causing objectionable tastes in drinking water and corrosion in industrial equipment. While present levels do not interfere with water use, the year-by-year increase at the Monroe water intake is noted as a warning of future problems.

Suspended and Settleable Solids. Suspended solids concentrations near Lake Erie bathing beaches ranged from 80 - 165 mg/l; Lake Erie itself had concentrations of 11 to 25 mg/l. Suspended solids in Lake Erie were highest near the mouths of the Raisin and Detroit Rivers, and have reached levels which interfere with water uses by settling out on the Lake bottom. These bottom deposits interfere with navigation, kill fish eggs and fish-food organisms, destroy spawning beds, and clog the gills and respiratory passages of fish.

Cyanides. Cyanides were found at the mouth of the Raisin River and once at Sterling State Park nearby in concentrations exceeding PHS drinking water standards and recommended maximums for protection of fish. Their presence in the water, even in minute quantities, poses a threat to fish and wildlife.

Iron. Average iron concentrations exceeding 0.30 mg/l were found near the mouth of the Detroit and Raisin Rivers. Iron is toxic to certain species of fish even in low concentrations; excessive quantities of iron can also cause tastes in municipal water supplies and stains in laundry, vegetables and plumbing fixtures.

Nitrogen. A pattern of high concentrations of nitrogen compounds radiates outward from the Detroit River. High levels of nitrates ranging from 0.35 to 0.50 mg/l were found in Brest Bay, and ammonia concentrations exceeding 0.30 mg/l extended down into the Lake approximately 10 miles from the mouth of the Detroit River. Inorganic nitrogen exceeds 0.30 mg/l in over 85 percent of the Michigan waters of Lake Erie.

Nitrogen in Lake Erie acts as a nutrient for algae and undesirable slimes which, in turn, can result in obnoxious odors; ammonia in particular interferes with domestic water treatment.

Phosphates. Phosphates also nourish objectionable algae and slimes, which add to general turbidity. Areas of high total phosphate concentration (0.20 - 0.50 mg/l) extended from the Detroit River south to Stony Point. Three areas of soluble phosphate exceed 0.10 mg/l as phosphate or 0.03 as phosphorus. One extends 6 - 3 miles south from the mouth of the Detroit River, one radiates out 1 - 2 miles from the Raisin River, and the third extends upward 3 - 4 miles from the Ohio State Line.

Richard D. Vaughan

Over 85 percent of the Michigan waters of Lake Erie contain inorganic nitrogen and soluble phosphates in excessive concentrations. The result has been undesirable algal blooms and serious interferences with water use. The City of Monroe has already been forced to move its water supply intake in order to avoid objectionable tastes and odors from algae.

Biology. Massive colonies of the filamentous slime bacteria Sphaerotilus, or "sewage fungus," and the filamentous green alga Cladophora were found at most stations in Lake Erie and along the bathing beaches near Bolles Harbor and in Brest Bay. These slimes, indicative of pollution, have fouled the nets of fishermen, interfered with boating, and washed up on beaches decaying and smelling.

Lake Erie also supports dense populations of plant and animal plankters, sometimes as dense as 22,400/ml. These microscopic organisms, in large numbers, can create nuisances: they clog filters in water plants, produce unpleasant tastes and odors in drinking water, and make the Lake water highly turbid.

Study of the bottom animal associations revealed polluted areas adjacent to the Raisin River and Sterling State Park, and at the mouth of the Detroit

River extending in the shape of a fan out into the Lake. Samples from the River below sources of pollution and from the Lake did not contain a single burrowing mayfly. The elimination of pollution-sensitive organisms such as these rob fish of much food, and may threaten certain species of fish with elimination.

Sources and Characteristics of Wastes

Over 95 percent of the waste constituents discharged from Michigan sources to Lake Erie originates from the Detroit River. The daily discharge from the United States portion of the River into Lake Erie contains the following loadings:

1. Over 10,000,000 pounds of chlorides.
2. Over 2,000 pounds of phenols.
3. Over 7,000,000 pounds of settleable solids.
4. Over 250,000 pounds of iron.
5. Over 200,000 pounds of phosphates.
6. Over 130,000 pounds of ammonia.
7. Over 300,000 pounds of total nitrogen.

After the Detroit River, the major polluter of Michigan Lake Erie is the Raisin River. The chief municipal waste discharge to the Raisin is from Monroe. The Monroe Sewage Treatment Plant provides primary treatment and, during the summer months, chlorination, and its operation is excellent. Efficiency in removal of suspended solids (62%) and BOD (59%) is high for a primary treatment plant, and bacterial control during chlorination is also good.

Although Monroe has separated its sewer system, a portion of the sanitary sewers still receives run-off from roofs. This results in hydraulic overloading at the plant, with a subsequent drop in efficiency, especially in maintenance of a chlorine residual in the effluent which will adequately reduce coliform organisms.

During the summer most bacterial loadings discharged to the Raisin River and subsequently to Lake Erie from the Monroe plant are significantly less than those from industrial sources. During non-chlorination months, however, the municipal plant is a significant source of coliform organisms to the Raisin River. Nitrogen and phosphorus compounds in the River originate in almost equal proportions from industrial and municipal sources.

Monroe industries discharge, daily, to the Raisin River:

1. Wastes equivalent in oxygen consuming capacity to raw sewage from a population of 225,000.

Richard D. Vaughan

2. Over 23,000 pounds of suspended solids, including 7,800 pounds of settleable solids.

3. Over 1,000 gallons of oil.

4. Over 1,000 pounds of cyanides.

5. Over 1,000 pounds of phosphates.

6. 16,000 pounds of chlorides.

7. Bacteria:

a. Total coliform as high as 3 million per 100 ml.

b. Fecal coliforms as high as 100,000 per 100 ml.

c. Fecal streptococci as high as 51,000 per 100 ml.

The lower Raisin River is frequently completely devoid of dissolved oxygen, resulting in a continuous state of putrefaction during the summer months. All uses of the lower Raisin River except waste disposal and navigation have been eliminated by pollution and deposits of settleable solids. Navigation is also hampered, and extensive annual dredging at the mouth is required to remove deposited wastes and keep the channels open for routine ship movement. Bacterial counts in the lower River make any recreational use of the water hazardous. The detrimental effect of the Raisin River upon the Lake is evident in the enrichment of the waters of the western basin and the high coliform levels at bathing beaches nearby (including Sterling State Park).

In addition to the Raisin River, several other tributaries to Lake Erie contribute wastes: They are the Huron River, Swan Creek, Stony Creek, Sandy Creek, Plum Creek and LaPlaisance Creek, with the Huron the most important. The Huron River carries significant quantities of coliform organisms, nitrates, and phosphates. It discharges into a large marsh at Pointe Mouillee with no clear pattern of dispersion into the Lake. The marsh is subject to backwater from the polluted waters of the Detroit River discharging into the Lake, and the specific effect of the Huron on the Lake is masked by this phenomenon. Long retention in the Pointe Mouillee marsh further complicates an evaluation of the Huron's share in polluting the Lake. After sources of pollution in the Detroit River have been substantially reduced, the actual waste contribution of the Huron River may be determined.

Sandy Creek discharges into Lake Erie at the northern edge of Sterling State Park, and is usually of poor bacteriological quality. Much of the time its flow is reversed, since the intake of the Ford Motor Co. plant and several paper mills that use its water exceed its normal flow. At periods of high runoff, however, its flow is higher (up to 60 cfs), and on such occasions it had an adverse effect on Lake Erie water.

Stony Creek and a small boat harbor near its mouth also have high coliform densities, and in times of heavy rain contributed wastes to the Lake.

Another important source of waste discharge into Lake Erie is storm-caused overflow. All along Lake Erie are shorefront pumping stations designed to receive surface drainage and automatically discharge it, untreated, into the Lake during or following rainfall. Discharge from improperly functioning septic tanks reaches the pumping stations along with surface runoff. A portion of Monroe's sanitary sewers still receives roof runoff, and this burdens the sewage treatment plant which must bypass directly to the River, without treatment except chlorination, all wastes over 10 MGD. In addition, a flood relief pumping station along the Raisin River interceptor bypasses the plant when unusually heavy rainfall or flood stage of the River inundates the sewer. The effect of storm-caused overflow on the River is most evident above known sources of pollution. In August 1963 a heavy rain caused the flood pumping station to operate for one hour, and coliform densities jumped to 10 times normal levels.

Unsewered shorefront houses also discharge sewage directly, or from improperly functioning septic tanks, to Lake Erie. Several tributaries, including Plum Creek and Sandy Creek, also receive such wastes.

Commercial and pleasure boats make heavy use of the Michigan waters of Lake Erie, and all such craft represent potential sources of pollution from oil and human wastes. Several reports of oil spills in the middle of the Lake waters under study indicate actual pollution from these sources.

There is also a table that should be included in the report, Table 12-VI.

(Table 12-VI is as follows.)

TABLE 12-VI. SUMMARY OF AVERAGE DAILY LOADING OF INDUSTRIAL WASTES BY EACH INDUSTRY TO RAISIN RIVER AT MONROE

Industry	BOD lbs.	BOD P. E.	Susp. Sol. lbs.	Sett. Sol. lbs.	Chlorides lbs.	Oil gal.	Phenols lbs.	Cyanides lbs.	Copper lbs.	Chromium lbs.	Phosphates lbs.
Consolidated Paper North Plant	17,204	101,000	7,823	780	0	123	11.0	0	0	0	-
Consolidated Paper South Plant	7,000	42,000	10,600	5,300	0	36	0.5	0	0	0	9
Ford Motor Company	48	287	8	3	16,000	870	3.8	1,075	700	136	1,046
Monroe Auto Equipment	NO WASTE CONSTITUENTS OF SIGNIFICANCE										
Monroe Paper Products	1,900	11,400	1,475	1,400	120	5	0.6	0	3	0	0
Union Bag-Camp Paper Co.	11,770	70,000	3,583	320	0	92	5.9	0	0	0	0
Total Raisin River(1)	37,900	225,000	23,500	7,800	16,000	1,130	21.8	1,075	703	136	1,060

(1) Rounded to three significant figures.

Richard D. Vaughan

Special Studies

In connection with the overall study of Lake Erie, several special studies were carried out on specific pollution problems not clearly defined by the routine investigations. The special studies included: three intensive surveys of the Raisin River, a pollution study of the Maple-Milleville Beach area, collection and analysis of bottom deposits in the Lake, hydrologic and current studies, and an investigation of bacterial contamination at Sterling State Park. (Results from the first three studies have been reported in the main body of this summary.)

Hydrologic Studies. The hydrologic studies showed, in general, that wind is the primary factor influencing water movement in the Michigan waters of Lake Erie except in the Detroit River debouchment where flow from the Detroit River is the predominant factor. Specific findings of special interest include the following:

1. The combination of wind patterns and Detroit River flow is such that polluted Detroit River water can affect water quality at beaches as far south as Swan Creek 75 to 85% of the time.

2. Predominant winds are southerly, producing northerly currents 40 to 45% of the time. Northerly

currents in turn bring polluted Raisin River water up to Sterling State Park beaches, accounting in part for the erratically high bacterial counts observed there.

3. Winds from the northeast and east, which occur approximately 20% of the time, could bring polluted Detroit River water into Brest Bay if they blew steadily for two days or more.

Sterling State Park. Study of bacterial contamination at Sterling State Park beach revealed several sources of the pollution. The Raisin River, as mentioned above, is probably the chief contributor of high coliform counts, since northerly currents are predominant. When southerly currents prevail, waste discharges from tributaries to the north of the Park, and from malfunctioning septic tanks affect the beach water. Control of these sources of pollution should restore water quality at the Park to levels safe for swimming.

Interferences with Water Uses

Municipal Water Supply. Algal growths in Lake Erie have in the past caused serious taste and odor problems in the public water supply of Monroe, and threaten to do so again. Ammonia concentrations at the Monroe water intake tend to lessen the effectiveness of chlorination.

Industrial Water Supply. Increasing chloride levels are a warning of future difficulties, for chlorides can cause corrosion in industrial equipment. The Raisin River is so grossly polluted in its lower reaches that it is offensive to sight and smell, and undesirable as a source of industrial water supply.

Recreation. Restriction of recreational opportunities in Lake Erie and its Michigan tributaries may be the worst damage from pollution, inestimable in dollar figures. At beaches near the mouth of the Detroit River, any kind of water contact sports -- even water skiing or boating -- is hazardous. The beaches at Sterling State Park, in heavy demand by a metropolitan population of nearly four million (projected to reach 5½ million by 1980), have had to be posted as unsafe for swimming. The beaches themselves are often offensive due to the washing ashore of rotting plant life and decomposing matter of sewage and industrial origin.

Fish and Wildlife Propagation. Sludge deposits on the bottom of Lake Erie threaten to destroy the food and habitat that make life possible for game fish. Large areas of Michigan Lake Erie's bottom are inhabitated only by pollution-tolerant organisms such as leeches and sludgeworms. Fish kills have been caused by discharges of oil and in 1960 a heavy discharge of untreated waste killed 10,000 to 12,000 ducks near the mouth of the Detroit River. Heavy algae blooms and dense populations of plankton add to the turbidity of the Lake water.

Navigation. Sludge deposits at the mouth of the Raisin and Detroit Rivers require expensive annual dredging to preserve routine navigability.

Eutrophication of Lake Erie. The natural aging of the Michigan section of Lake Erie is being accelerated by the discharges of nutrients and organic wastes. The deleterious effects of nitrate and soluble phosphate loadings are observable in the abnormally high pulses of plankton, the widespread blooms of taste and odor producing algae, and the nuisance growths of filamentous sewage fungus and blanket weed. Another symptom of advancing eutrophication is low summer oxygen levels. Disappearance of the once-abundant mayfly larvae and the smothering of spawning beds with settleable solids may be a contributing factor to the recent decline of Lake Erie walleye and whitefish. Unless the discharge of nutrients and organic wastes is not halted, eutrophication of the Lake may rapidly increase until it becomes unsuitable for most purposes.

This concludes the discussion of findings on Lake Erie. I would now like to read the conclusions of the report.

CONCLUSIONS

Every day more than 1.6 billion gallons of waste water flow into the Detroit River -- 1.1 billion gallons from industry and 540 million gallons from municipal sewage. Huge quantities of waste products contained in this discharge change the Detroit River from a basically clean body of water at its head to a polluted one in its lower reaches. These waters are polluted bacteriologically, chemically, physically, and biologically, and contain excessive coliform densities as well as excessive quantities of phenols, iron, oil, ammonia, suspended solids, settleable solids, chlorides, nitrogen compounds, and phosphates. Pollution of the Detroit River will become progressively worse unless effective action is taken immediately.

The City of Detroit's main sewage treatment plant, serving more than 90 percent of the people in the

Project area, contributes 95 percent of the municipal waste to the Detroit River and is also the major source of suspended solids, phenols, oil, inorganic nitrogen, phosphates, and biochemical oxygen demand in the river. Overflow from combined sewers in Detroit and its suburbs, carrying both stormwater and raw sewage, contributes greatly to the degradation of the river.

In the upper Detroit River, the Great Lakes Steel Co. and the Allied Chemical Corp. are the major sources of industrial wastes. The Ford Motor Co. is the principal contributor of inorganic wastes to the Rouge River, and the Scott Paper Co. is the principal contributor of organic wastes. Downriver industries contributing significant quantities of wastes are the Great Lakes Steel Corp., the McLouth Steel Corporation, Pennsalt Chemical Corporation, and Wyandotte Chemical Corporation. On the Raisin River the leading polluters are the two Consolidated Paper Company mills, Monroe Paper Products Company, and the Union Bag-Camp Paper Company.

Other significant sources of pollution in the study area are overflows from combined sewers, municipal and industrial waste spills, and wastes from shorefront homes.

Pollution of the Detroit River causes interference with municipal water supply, recreation, fish and wildlife propagation, and navigation. Two municipal water intakes, particularly that of Wyandotte, are endangered by the high bacterial counts of the river, and the rising chloride levels indicate potential future problems for industrial water usage. In addition, high concentrations of phenols and ammonia at the Wyandotte water intake have interfered with municipal water treatment by causing taste and odor problems and reducing the effectiveness of chlorination. Excessive quantities of chlorine are needed to reduce bacteria to a safe level.

All forms of water contact sports in the lower-Detroit River are hazardous. Declining levels of dissolved oxygen in the lower Detroit River as it enters Lake Erie are approaching the danger point, indicating trouble in the future unless appropriate remedial action is taken. Together with bottom sludge deposits, oils, and toxic materials, they threaten fish, migratory birds, and other wildlife. In order to maintain navigation, extensive annual dredging is required at the junction of the Detroit and Rouge Rivers and at the mouths of the Detroit and Raisin Rivers to remove deposits of suspended solids in large part originating in municipal and industrial waste discharges.

Richard D. Vaughan

About 6 million pounds of waste products are discharged every day from U. S. industries and municipalities to the Detroit River. 20 million pounds of measured waste constituents are discharged every day from U. S. waters of the Detroit River to Michigan waters of Lake Erie. The Raisin River, grossly polluted at its mouth, also pollutes the Michigan waters of Lake Erie.

The Michigan waters of Lake Erie have two major zones of pollution -- one in the vicinity of the mouth of the Detroit River, and one near the mouth of the Raisin River.

Bacteriological densities in the Lake from the mouth of the Detroit River to a point 2 or 3 miles south make the water unfit for recreational use; following heavy rainfall in the Detroit area, this zone is extended southward to Stony Point. The periodic contamination of Sterling State Park beaches, which are posted as unsafe for swimming, is caused by wastes from the Raisin River and septic tank discharge.

Concentrations of chlorides, metals toxic to fish life in minute concentrations, and suspended solids in the Lake portend future problems in various water uses. Composition of bottom organisms in the Detroit River changes from a pollution-sensitive population typically found in clean waters to a predominantly pollution-tolerant population in the lower River.

Pollution-stimulated algae growths have forced Monroe to move its water intake point to avoid unpleasant tastes and odors in the water, and algae blooms near the new intake again threaten to degrade Monroe's drinking water. Discharges of nutrients and organic wastes into the Michigan part of Lake Erie have speeded the enrichment of that portion of the Lake.

Water at Sterling State Park is erratically polluted, and this area occasionally had coliform counts exceeding 100,000 organisms per 100 ml. A standard frequently accepted as safe for recreation is 1,000 per 100 ml, and the recommendations in this report are based on that standard. The Raisin River was discovered to be the primary cause of this pollution; when Lake currents are northerly (40 to 45% of the time), polluted Raisin River water is carried directly to the beaches. When currents are southerly, polluted drainage from septic tanks reaches the Park. To improve water quality at Sterling State Park, these sources of pollution must be controlled.

Adverse effects of stormwater overflow on water quality were seen in the waters studied by the

Project. During and after heavy rainfall, sewage plants must bypass untreated wastes directly to the rivers, and this can occur on 33 to 45 days a year. The overflows averaged 8.2 hours and have lasted as long as 24 hours, and the detrimental effects from a single storm have lasted as long as 5 days. Bacteria in storm overflows often approached the densities found in raw sewage, with counts as high as 100 million per 100 ml. Storm-caused overflows alone are responsible for the discharge of 5 billion gallons of raw sewage to the Detroit River yearly.

While there is some evidence that water quality is improving, because of increased water uses damages are increasing, and unless remedial action is taken immediately the usefulness of the water resources of the Detroit area may be destroyed completely by pollution.

Thank you.

MR. STEIN: Just one moment, Mr. Vaughan.

MR. VAUGHAN: I'm sorry.

MR. STEIN: Do you have any films to show now?

MR. VAUGHAN: I think there are some slides right now.

MR. POSTON: Will you put on some of the

slides to show some of the conditions along the river at this time?

MR. VAUGHAN: Yes.

MR. POSTON: Mr. Vaughan will narrate these, and Mr. Harlow will point them out.

MR. VAUGHAN: Mr. Harlow is going to narrate the slides.

MR. POSTON: I think, Mr. Chairman, that some of the consultants, and perhaps Mr. Oeming, could see a little better if they were out front.

MR. STEIN: I would suggest that what we will do, and I hope Mr. Vaughan is still within earshot, is, after the slides are presented we will recess for lunch.

How long will the slides take?

MR. POSTON: Ten minutes.

MR. STEIN: I want to again emphasize that this afternoon we may have Governors Romney, Rhodes and Rockefeller coming here to make statements. If they do, it is going to cause a rather tight schedule. We will interrupt the Government presentations and ask the Governors to make their statements at that time.

Mr. Vaughan, I want to commend you on making a very detailed report indicating precisely what you found and the reasoning behind your conclusions.

Richard D. Vaughan

I would suggest that if there are any people who would differ with that or who have questions wait until we have completed the entire report.

The issue is pretty firmly joined, and I think we are in a position to clarify the situation.

That is one of the best reports that I have encountered in all the years that we have been doing this.

Would you proceed, Mr. Harlow?

STATEMENT OF GEORGE L. HARLOW,
SANITARY ENGINEER AND DIRECTOR,
DETROIT RIVER - LAKE ERIE PROJECT,
U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, PUBLIC HEALTH
SERVICE

MR. HARLOW: Mr. Chairman, Conferees, Members of the Michigan Water Resources Commission, Ladies and Gentlemen:

For the record, I am George Harlow, Senior Sanitary Engineer of the U. S. Public Health Service, and present Director of the Detroit River - Lake Erie Project.

I shall be showing some slides that the Project took during the three years that we studied the area here. I don't think these need to be made a part of the record, nor the comments that I make on each one. Just the fact that the slides are being shown I think is all that is necessary.

What do you think about that?

MR. STEIN: I think we had better have as part of the record at least your comments.

MR. HARLOW: All right.

MR. STEIN: I won't agree to print the slides in the record in color, because of the expense, but I think we will take your comments. The slides will be made an exhibit and be available in Washington, Chicago, and Detroit, as long as we maintain an office here.

MR. HARLOW: These slides are pictures that we took of water uses, waste discharges, and pollution conditions.

May we have the houselights out, please?

The first slide (indicating) shows a picture of Maple Beach, one of the beaches that is along the western shoreline of Lake Erie.

The next slide (indicating) shows fishing, a recreational sport in the area, in the lower Detroit River.

This slide (indicating) is a picture taken from the air of Sterling State Park Beach on western Lake Erie. Here we can see the sign posted at Sterling State Park saying "Unfit for Swimming," and the sunbathers on the beach. That (indicating) looks like a pile of debris, but is actually a sunbather.

This (indicating) is another picture taken of Sterling State Park, and you can see the general condition of the beach.

Again we have a picture taken at Sterling State Park (indicating). We have some bathers definitely bathing in the water, and this dead fish beside them.

Here (Indicating) we have some bathers at Dewey Beach, another one of the beaches along the western Lake Erie shoreline.

This (indicating) is the discharge and accompanying discoloration of the Detroit River from the outfall of the Detroit Sewage Treatment Plant.

This is the Detroit River here (indicating). This tributary coming in here (indicating) is the Rouge River, and this land mass is Zug Island.

This (indicating) is another picture showing the Detroit Sewage Treatment Plant outfall from a different section as the wastes boil up from the bottom of the Detroit River and proceed downstream.

This is the Rouge River coming in from this direction (indicating), and Zug Island here.

This (indicating) is our Project boat right there discharging dye used as tracers into the effluent of the Detroit Sewage Treatment Plant in order to trace it downstream.

These (indicating) are two clarifiers, two waste treatment devices used by the Ford Motor Company Rouge plant. The discharge from these two clarifiers is at this point here (indicating), and you are able to see the change in the color of the river, with this demarcation line (indicating) caused by the material discharged from these two clarifiers of the Ford Motor Company. The direction of the flow of the Rouge River is this way (indicating).

This (indicating) is another waste treatment device of the Ford Motor Company, an oil separation device that they have installed on the Ford plant. The Rouge River is out in this direction (indicating). You can see the oil that has been accumulated and trapped inside the waste treatment device of the Ford Motor Company Rouge plant.

This (indicating) is the discharge and accompanying discoloration of the Rouge River from the Scott Paper Company. This is the Zug Island cut, and the direction of flow is in this direction (indicating).

This (indicating) is an outfall discharging material from the Great Lakes Steel Corporation on Zug Island. This is a Blast Furnace Division, and you can see the discoloration of the river from this outfall.

This (indicating) is another outfall from the Great Lakes Steel Corporation on Zug Island, and you can see how it discolors the river.

This (indicating) is one of these same two outfalls taken from the air showing the discharge, and how it discolors the Detroit River. The direction of flow, of course, is in this direction (indicating).

This (indicating) is the outfall of the Great Lakes Steel Corporation 80-Inch Hot Strip Mill. There are actually two outfalls there discharging approximately 80 million gallons a day.

This outfall on this side (indicating) contains primarily cooling water, and this outfall on this side (indicating) contains the process waste material, and you can see how it discolors the river. You can see the size of these outfalls by looking at these railroad cars (indicating).

This (indicating) is one of the outfalls from the oil separating devices, another treatment device used by the Great Lakes Steel Corporation at Ecorse. The oil rises to the surface in these flexion devices and is trapped, and is taken away to prevent pollution entering the Detroit River from oil wastes.

This (indicating) is the outfall from the Wyandotte Chemical Corporation North Plant.

George L. Harlow

This (indicating) is an outfall and accompanying discoloration of the Detroit River from the McLouth Steel Corporation. This device here (indicating) is one of their treatment devices, as well as are these two circular devices here (indicating). You can see how the pollution collected along the shore had a heavier concentration.

This (indicating) is the Gibraltar area in the lower Detroit River taken from the air. This tributary coming in here is the Frankenford Drain. The discoloration or the red color of the Frankenford Drain as it enters the Gibraltar area is attributable to discharge from the Gibraltar plant of the McLouth Steel Corporation. The Detroit River is in this direction (indicating).

This (indicating) is the waste outfall from the Union Bag-Camp Paper Company in the Raisin River, and the North Plant of the Consolidated Paper Company. The waste material is entering the Raising River, and at the time this picture was taken, the wastes were going upstream.

This (indicating) is the turning basin on the Raisin River, and the wastes are going upstream and meeting this black waste coming downstream.

George L. Harlow

Here (indicating) is that black waste I mentioned in the slide before entering the Raisin River from the Consolidated Paper Company South Plant. The Raisin River to Lake Erie is in this direction (indicating).

This (indicating) is a picture taken in 1962 of a malfunctioning stormwater overflow outlet. This outlet discharged raw sewage during dry weather because a regulator malfunctioned. This discoloration of the dark blue or purplish color (indicating) is raw sewage entering the Detroit River.

This picture (indicating) was taken just recently, and shows the outfall from Connors Creek, the system that carries the combined storm and sanitary sewage of the City of Detroit in this area of the city, and during a storm it is discharged into the Detroit River. This is the Detroit River out here (indicating). The direction of flow is this way (indicating), and you can see the discoloration of the wastes entering the river from Connors Creek.

This (indicating) is another picture taken at the same time. This is Connors Creek and the combined sewage entering the river.

This slip here (indicating) is where the intake of the Connors Creek Detroit Edison Power Plant is located. They take their water in this area.

This (indicating) is another picture showing Connors Creek here, taken at the same time. This is where Detroit Edison takes their water in, and this is where they discharge it, and you can see how the discharge from the Detroit Edison plant is pushing the waste material out farther into the river.

Proceeding downstream at the same time, we can see, at the Lee and Jefferson stormwater overflow outlet, that during this same storm, this outfall was discharging a considerable amount of waste material, and you see how it discolors the river. These are two large boats parked there (indicating).

This (indicating) is another picture of the same thing, showing it at a different angle.

This (indicating) is a picture taken recently from the air of the Rouge River. The direction of flow is in this direction (indicating). This red colored waste is caused by the discharge from the Ford Motor Company Rouge plant.

This (indicating) is the Zug Island cut entering the Rouge River, and you can see the difference in the color between the Zug Island cut, which, in reaches of it, had relatively clean water to the pollutedappearing condition of the Rouge River. The Detroit River is out in this direction (indicating). This is Zug Island (indicating).

This (indicating) is a picture taken on the same day of the Rouge River as it enters the Detroit River. Again you see the orange or red colored type material. This black line (indicating) and these other black lines are oil slicks.

This (indicating) is Zug Island, and the direction of flow of the Detroit River is in this direction (indicating).

This (indicating) is a picture -- you can't see it too well -- of the Detroit Edison plant at the mouth of the Rouge River.

I think this picture shows it better (indicating), and this is where the Detroit Edison plant takes their water in, and you can see that, as it appears, they did not have good quality water on this day.

Downstream a short ways, just off of the Town of Rouge, we can see the wastes from the Rouge River as it discolors the Detroit River. The direction of flow is in this direction (indicating).

This (indicating) is a park called Ballinger Park where a boat marina is. This happens to be the shadow of the helicopter (indicating).

This (indicating) is the way the outlet of the Detroit Edison Rouge plant comes out.

This (indicating) is a picture of the Corps of Engineers Dredge Haynes as it proceeds to the Grassy Island Dumping Ground to dispose of the dredge material that it has just removed from the Rouge River. You can see, as he chugs downstream, he was losing some of the material that he had picked up in the Rouge River.

This (indicating) is a picture of the Raisin River coming out in this direction, taken from the air, as it enters Lake Erie, and you can see the effects of the wastes from the Raisin River as it entered Lake Erie.

Sterling State Park is up in this direction (indicating). Bolle Harbor would be down in this direction (indicating).

This (indicating) is a picture of McLough Steel Corporation on a day when they had a waste spill. This is their clarifier (indicating), and apparently it was malfunctioning that day, discharging this heavy black material containing iron, suspended solids, and oil, and how it affected the downstream part of the Trenton Channel.

This (indicating) is the Trenton Channel, and this is Grosse Ile (indicating).

Again, as this slate material proceeded downstream, this is the Riverview Osteopathic Hospital located in Trenton (indicating).

Those are all the slides. Thank you.

MR. STEIN: Thank you very much.

We will stand recessed until a quarter to two.

(Luncheon recess taken at 12:15 p.m.)

AFTERNOON SESSION

1:45 P.M.

MR. STEIN: May we reconvene?

Mr. Poston.

MR. POSTON: Mr. Harlow will continue with the presentation and the study. Mr. Harlow is in charge of our activities at our Project.

MR. HARLOW: I shall now be presenting these recommendations of the Detroit River - Lake Erie Project of the Public Health Service.

Recommendations for abating water pollution interfering with water use in the Detroit River, the Michigan waters of Lake Erie, and their tributaries will be made in two groups: general recommendations, covering the broad objectives of pollution abatement in the Project area, followed by specific recommendations for the solution of particular problems. All recommendations concerning municipal and industrial wastes refer only to Michigan facilities whose discharges reach the Detroit River or Lake Erie either directly or through a tributary.

The specific recommendations are offered in addition to, and not in place of, the general recommendations.

The recommendations which limit the effluent concentration of a particular waste constituent are made with the goal of reduction of overall loadings from a facility. If changes in concentration are brought about by increased dilution, combination of outfalls, or other methods without reducing waste loading, a corresponding decrease in recommended waste concentrations will be required.

While artificial fertilization of the Michigan waters of Lake Erie is a severe problem, no recommendations are made at this time concerning the installation of specialized treatment facilities designed to reduce phosphorus and nitrogen compounds in the effluent of municipal waste treatment works. Proper operation of secondary treatment facilities of the activated sludge type will result in significantly greater removal of these constituents than that produced by primary treatment alone.

GENERAL RECOMMENDATIONS

The following are the general recommendations

George L. Harlow

of the Detroit River - Lake Erie Project staff.

It is recommended that:

1. All municipalities provide a minimum of secondary treatment plus adequate disinfection of the effluent.

2. Sewerage systems with collection sewers terminating in adequate treatment facilities be provided in those areas along the Michigan shore of Lake Erie and the Detroit River where sewers do not now exist and homes discharge either raw wastes or septic tank effluent to the watercourse.

3. All industries in the area discharging waste material to the public waters maintain an inventory of all waste treatment equipment and supplies on the plant premises so that a minimum delay in effective waste treatment will result when replacement or repair is necessary.

4. A program be developed to reduce the likelihood of accidental spills of waste material to the river. In-plant surveys with the purpose of anticipating possible accidents are recommended.

5. All new sewerage facilities be designed to prevent the necessity of bypassing untreated wastes during maintenance and renovation operations.

6. Municipal waste treatment plants regularly analyze all waste constituents contributing to pollution found in significant quantities in their wastes, as specified by the Michigan Water Resources Commission.

7. Industries discharging wastes to the public streams furnish operating records to the Michigan Water Resources Commission containing information on waste discharges and concentrations as specified by the Commission.

8. Regular monitoring of the Detroit River, Lake Erie, and their tributaries be conducted cooperatively by the Michigan Water Resources Commission and the Public Health Service. Such monitoring should include regular sampling of waste effluents and overflows from combined sewers. Use of aerial techniques for reconnaissance and pollution surveillance as practiced by the Michigan Water Resources Commission is encouraged and expansion of this activity recommended. Monitoring should include surveillance of oil discharge from vessels.

9. A PHS Water Pollution Control Surveillance Station (formerly National Water Quality Network Station) be established in the lower section of the Detroit River. This would be in addition to the network station now in operation at the head of the Detroit

River. Two stations would illustrate the waste burden put into the Detroit River and the change in its condition as it flows toward the Lake as well as indicate changes in water quality after improvements have been made.

10. The U. S. Department of Health, Education, and Welfare, through the auspices of the International Joint Commission, bring to the attention of Canadian water pollution control authorities the significant waste contributions from Canadian sources on the Upper St. Clair River adversely affecting water quality in the United States section of the Detroit River. They should be encouraged to bring about more effective pollution abatement to protect downstream water use.

The following are the specific recommendations for Municipal Waste Treatment on the Detroit River:

Detroit (Belle Isle Sewage Treatment Plant)

This plant discharges an effluent of low waste concentrations, and treatment efficiency is within accepted limits for this type of facility. Total coliform and fecal streptococcus densities in the effluent were high (7,890,000 and 297,000) but should be expected in this type of plant without chlorination.

The City of Detroit plans to abandon this plant and pump sewage from Belle Isle across to the mainland and into the Detroit system. Such a plan is recommended as the most practical under the circumstances. Until this plan can be carried out, it is recommended that full-time chlorination of the plant effluent be instituted, capable of producing an effluent with monthly geometric mean coliform densities not exceeding 5,000/100 ml. This recommendation is made to prevent interference with municipal water supplies and recreational use of water.

Detroit (Main Treatment Plant)

Sewage influent at the Detroit plant is of average strength from the standpoint of BOD and suspended solids concentrations but contains high levels of waste constituents normally not associated with municipal wastes, including oil and grease, phenols, copper, iron, chromium, nickel, zinc, and lead.

Average phenol and oil concentrations in the effluent exceed 20 micrograms per liter and 15 mg/l respectively. Ammonia-nitrogen concentrations and loadings in the effluent are excessive, as is the phosphate effluent concentration (36 mg/l and 145,000 lbs/day). Efficiency in removal of settleable solids (52%), suspended solids (39%), and BOD (17%) is poor, indicating an overloaded and in some respects inadequate primary facility (e.g., the holding time in the settling basins is less than one hour).

Bacteria removal during the survey was excellent and density in the effluent very low. This presumably was accomplished by raising the level of chlorination; and while averages during the survey do not correspond with mean monthly averages during the study period, they show that effective bacterial control can be accomplished.

MR. STEIN: Excuse me. You will notice there is a change.

MR. HARLOW: That is right. In the fourth paragraph down, it should be 20 micrograms, and then it should also be 15 micrograms per liter, respectively.

MR. STEIN: Yes, I noticed that.

MR. HARLOW: Waste loadings from the main plant of the City of Detroit are not only responsible for a large part of the degradation of the waters of the lower Detroit River but also constitute a major source of nitrogen compounds and the major source of phosphates going into and contributing to the fertilization of Lake Erie. The major contribution of waste constituents from municipal sources being discharged into the Detroit River and subsequently into Lake Erie originates from this plant.

It is recommended that:

1. A minimum of secondary treatment facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/l

b. Settleable solids concentration of 5 mg/l

c. Ammonia concentration of 2 mg/l

d. Phenol concentration of 20 micrograms per liter

e. Oil concentration of 15 mg/l

f. Biochemical oxygen demand of 20 mg/l

2. Bacterial reduction facilities be operated at levels capable of providing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml.

3. A technical committee appointed by the conferees will evaluate actual phosphate removal of the secondary treatment plant after it is in operation. On the basis of this evaluation, if further facilities for

the removal of phosphates are necessary, the conferees will consider making such a recommendation. A similar program will be put into effect concerning the removal of nitrogen compounds.

Wayne County Sewage Treatment Plant (Wyandotte)

The plant was greatly overloaded when the Project began, and it was necessary to bypass untreated wastes for a portion of most days to the Detroit River. Enlargement of primary facilities was designed to alleviate this condition. The surveys performed at this plant by the Project staff were made on the original facilities, and do not reflect the recent enlargement.

Two surveys at this plant revealed an influent sewage of average strength in terms of BOD and suspended solids, but with other waste constituents at levels normally not associated with domestic sewage (phenols, oil and grease, iron, chromium, copper, cadmium, nickel, zinc, and lead).

Average concentrations of suspended solids and settleable solids and discharges to the River were high during the two surveys. Average BOD in the effluent during the first survey was 120 mg/1, with a population equivalent of 132,000 discharged. Levels of nitrogen compounds were significant, and phosphate concentrations were at 40 mg/l (unusually high) with a loading of 7,200 pounds per day.

Bacteriological control was excellent during the first survey when chlorination of the effluent was practiced. Geometric mean densities for total coliforms, fecal coliforms, and fecal streptococci during the first survey were less than 100 organisms per 100 ml. Study of plant operation records reveals that these results were not typical, but it is encouraging to note onee again that results in this magnitude can be obtained. During the second survey effluent chlorination was not practiced, and geometric means for total coliforms, fecal coliforms, and fecal streptococci exceeded one million organisms per 100 ml.

Discharges of suspended solids, nitrogen compounds, phosphates, and organic matter from the Wyandotte plant contribute significantly to the degradation of the Detroit River and the fertilization of Lake Erie.

It is recommended that:

1. A minimum of secondary treatment facilities be provided capable of producing an effluent containing not more than:

a. Suspended solids concentration of 35 mg/l

b. Settleable solids concentration of 5 mg/l

c. Oil concentration of 15 mg/l

d. Biochemical oxygen demand of 20 mg/l

2. Bacterial reduction facilities be operated at levels capable of providing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

3. A technical committee appointed by the conferees will evaluate actual phosphate removal of the secondary treatment plant after it is in operation. On the basis of this evaluation, if further facilities for the removal of phosphates are necessary, the conferees will consider making such a recommendation. A similar program will be put into effect concerning removal of nitrogen compounds.

The above recommendations are made to protect recreational use of water, navigation, and fish and wildlife propagation.

Wayne County Sewage Treatment Plant (Trenton)

It is recommended that:

1. A minimum of secondary treatment facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/1

b. Settleable solids concentration of 5 mg/1

2. Bacterial reduction facilities be operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

The above recommendations are made to prevent interference with recreational use of water and fish and wildlife propagation.

Wayne County Sewage Treatment Plant (Gross Ile)

It is recommended that:

1. A minimum of secondary treatment facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/1

b. Settleable solids concentration of 5 mg/1

2. Bacterial reduction facilities be operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

The above recommendations are made to prevent interference with recreational use of water and fish and wildlife propagation.

I will now be giving the recommendations for Industrial Waste Treatment.

Pollution control is considered satisfactory at this time for the following industries and no specific recommendations for improvement are made. These industries are:

Parke-Davis Company
United States Rubber Company
American Agricultural Chemical Company
Chrysler Corporation, Amplex Division
Chrysler Corporation, Cycleweld Division
Enrico Fermi Atomic Reactor
Monroe Auto Equipment Company

Waste discharges from the following industries were not found to interfere with existing water uses in the Detroit River or Michigan Lake Erie. These industries are:

Koppers Company
Anaconda-American Brass Company
Allied Chemical Corporation
    General and Plastics Division, and for
    Semet-Solvay Division with the exception
    of oil wastes as reported by the Michigan
    Water Resources Commission
Chrysler Corporation - Engine Division
Dana Corporation
Propylene Oxide Plant of Wyandotte Chemical
    Corporation

The recommendations for industrial waste treatment, as well as the municipal waste just given, are made to prevent interference with navigation, fish and wildlife propagation, recreational use of water, and to protect municipal and industrial water supply.

Recommendations are made for those industries discharging excessive suspended and settleable solids that facilities be provided capable of producing an effluent not to exceed:

a. A suspended solids concentration of 35 mg/1; and

b. A settleable solids concentration

of 5 mg/l.

These industries are:

Allied Chemical Corporation (Solvay Process
    Division)

Great Lakes Steel Corporation
    Blast Furnace Division
    80" Hot Strip Mill
    Ecorse Plant

Revere Copper and Brass, Inc.

American Cement Corporation (Peerless Division)

Ford Motor Company Rouge Plant

Scott Paper Company

McLouth Steel Corporation Trenton and Gibraltar Plants

Mobil Oil Company

Pennsalt Chemical Corporation - East and West Plants

North and South Plants of Wyandotte Chemical Corporation.

Paper Plants of Consolidated, Union Bag-Camp and Monroe Paper Products on the Raisin River.

The following specific recommendations for each industrial waste source are given now, in addition to those already presented.

In regard to the Allied Chemical Corporation (Solvay Process Division) outfall that discharges from Zug Island directly to the Detroit River, wastes from this plant have high concentrations of suspended and settleable solids, phenols, and chlorides. Chloride loadings from this source represent approximately 20 percent of the entire industrial loading to the Detroit River. Suspended and settleable solids loadings and effluent concentrations indicate a lack of waste control.

It is recommended that:

1. Facilities be provided capable of producing an effluent not to exceed:

   a. Suspended solids concentration of 35 mg/1

   b. Settleable solids concentration of 5 mg/1

2. The industry begin investigation of satisfactory methods of disposing of chlorides and alternate methods of disposal of concentrated brines, such as subsurface disposal.

The above recommendations are made to prevent interference with navigation and fish and wildlife propagation and to protect municipal and industrial water supply.

George L. Harlow

In regard to Great Lakes Steel Corporation - Blast Furnace Divisions, waste treatment facilities provided for the removal of phenols and suspended solids are ineffective. Nearly 100 percent of the suspended solids in the plant effluent were found to be readily settleable.

It is recommended that:

1. Facilities be provided capable of producing an effluent not to exceed:

   a. Phenol concentration of 20 micrograms per liter

   b. Ammonia concentration of 2 mg/l

In regard to the Revere Copper and Brass, Inc., the concentrations of oil and settleable solids in the effluent from this installation are excessive. All of the suspended solids released by this industry are readily settleable.

It is recommended that:

Facilities be provided capable of producing an effluent containing not more than:

An oil concentration of 5 mg/l

In regard to the Allied Chemical Corporation (Solvay Process Plant) that discharges its waste to the Zug Island cut of the Rouge River, wastes from this plant have excessively high concentrations of phenols and chlorides. Chloride loadings represent approximately 10 percent of the entire industrial load to the Detroit River. Suspended solids loadings averaged 10,000 pounds per day.

It is recommended that:

The industry should begin investigations of satisfactory methods of disposing of chlorides and alternate methods of disposal of concentrated brine, such as subsurface disposal.

In regard to Darling and Company, survey reports indicate inadequate facilities for control of BOD and coliform organisms. This plant discharges to the Rouge, and subsequently to the Detroit River, wastes equivalent in oxygen-consuming capacity to the untreated wastes of over 40,000 persons.

It is recommended that:

Facilities be provided capable of producing an effluent not to exceed:

a. Monthly geometric mean coliform density of 5,000/100 ml

b. Biochemical oxygen demand of 20 mg/l

In regard to the Ford Motor Company Rouge Plant, wastes from this plant represent, in volume, approximately 83 percent of the industrial wastes being discharged into the Rouge and subsequently into the Detroit River. Phenolic wastes exceed the limit of 600 pounds per day set by the Michigan Water Resources Commission. Concentrations of iron, phenols, and oil exceed 17 mg/l, 20 micrograms per liter, and 15 mg/l, respectively. Suspended and especially settleable solids are excessive at times, while excellent control was achieved on other occasions. Acid discharged in the form of spent pickling liquor is excessive and imparts an unnatural color to the Rouge and Detroit Rivers.

Phenols, iron, and oil and grease from this industry constitute over 90 percent of the loading from industrial sources to the Rouge River. Improvement must be accomplished at this source if significant reduction in waste loadings to the Rouge River and subsequently to the Detroit River is to be effected.

It is recommended that:

1. Facilities be provided or existing facilities operated to produce an effluent not to exceed:

   a. Phenol concentration of 20 micrograms per liter

   b. Ammonia concentration of 2 mg/l

   c. Iron concentration of 17 mg/l

George L. Harlow

2. Oil removal facilities be operated to limit the oil concentration in the effluent to 15 mg/l. In addition, the industry should investigate methods of further reduction in oil discharged in the plant effluent by in-plant control.

In regard to the Scott Paper Company, the effluent contains excessive quantities of suspended solids. Over 31,000 pounds of suspended solids per day are discharged to the Rouge and subsequently to the Detroit River. This industry discharges to the receiving stream wastes equivalent in oxygen-consuming capacity to the untreated sewage from a population of over 800,000 persons.

It is recommended that facilities be provided capable of producing an effluent not to exceed:

Biochemical oxygen demand of 85 mg/l

In regard to the E. I. du Pont de Nemours and Company, this company was found not to be in compliance with the restriction on pH set for it by the Michigan Water Resources Commission.

In regard to the Firestone Tire and Rubber Company, excessive concentrations of iron were found in the plant effluent. Over 5,000 pounds per day of this substance were discharged to the Detroit River.

George L. Harlow

It is recommended that iron concentration in the effluent be reduced to levels not exceeding 17 mg/l.

In regard to the Fuel Oil Corporation, excessive concentrations of oil were found in the effluent from this installation when ships were being washed. At these times the concentrations are over 300 mg/l.

No specific recommendations for improvement are made, since the Michigan Water Resources Commission has reported that this industry has recently suspended ship-washing operations. It is recommended not to permit resumption of such operations until controls are instituted to limit oil in the effluent to 15 mg/l.

In regard to the Great Lakes Steel Corporation 80" Hot Strip Mill, the Michigan Water Resources Commission reports excessive oil discharges, and controls should be instituted to limit effluent to conform with the Commission's order.

In regard to the Great Lakes Steel Corporation Plant at Ecorse, excessive concentrations and significant quantities of oil, iron, suspended solids, settleable solids, and acid are discharged. Over 50 percent of the iron and acid loadings to the Detroit River originate here. Effluents containing acid wastes are far below pH 5.5, and these wastes are mainly responsible for lowering the Detroit River below pH 4.0 in the vicinity of the plant.

It is recommended that:

1. Acid wastes be controlled so that discharges fall within the range pH 5.5-10.6.

2. Facilities be provided or existing facilities operated to produce an effluent not to exceed:

a. Oil concentration of 15 mg/l; and

b. Iron concentration of 17 mg/l.

In regard to the McLough Steel Corporation at Gibraltar, control of oil, iron, and suspended solids discharges at this plant is marginal, with improvement noted during the last months of study.

It is recommended that:

All waste treatment practices be reviewed and steps taken to improve the effluent to conform consistently to the Order of Determination issued by the Michigan Water Resources Commission.

In regard to the McLouth Steel Corporation Plant at Trenton, the waste treatment facilities of this installation have been very erratically operated from the standpoint of control of suspended solids, settleable solids, iron, phenols, oil, and pH. At times excellent treatment was achieved; at other times complete lack of treatment effectiveness was observed, with concentrations of solids, oil, phenols, and iron exceeding the Order of Determination of the Michigan Water Resources Commission.

Since it has been demonstrated that this industry can achieve effective pollution control by operation of its existing facilities, it is recommended that steps be taken to assure an effluent not to exceed:

a. An iron concentration of 17 mg/1; and

b. An oil contration of 15 mg/1

In regard to the Mobil Oil Company, during the survey the concentration of oil in the plant effluent was excessive, and additional grab samples before and after the survey indicated erratic operation. Effective operation of the industry's oil separation facilities should also improve suspended solids removal.

It is recommended that:

Existing facilities be operated effectively or additional facilities provided to assure an oil concentration in the effluent not to exceed 15 mg/1 at all times.

In regard to the Monsanto Chemical Corporation, waste treatment at this installation is satisfactory with the exception of phosphate concentrations and loadings in the plant effluent. Over 10,000 pounds per day of phosphates are discharged into the Detroit River.

It is recommended that treatment be provided to reduce concentrations and loadings of phosphates by approximately 80%.

In regard to the Pennsalt Chemical Corporation East Plant, the concentrations of chlorides, suspended solids, and settleable solids in the plant effluent were excessive. Approximately 1/2 million pounds of chlorides per day were discharged to the Detroit River, representing about 20 percent of the total chloride discharge to the River.

It is recommended that:

The industry begin investigation of satisfactory methods for disposing of chlorides and alternate methods of disposal of concentrated brines, such as subsurface disposal.

In regard to the Pennsalt Chemical Corporation West Plant, wastes from this plant had excessive concentrations of phenols, suspended solids, and settleable solids. Phenol concentrations were found over 1,000 micrograms per liter but no interference with existing water uses in the Detroit River or Michigan Lake Erie was apparent at this time.

George L. Harlow

It is recommended that:

The entire waste disposal program of this plant be carefully investigated by company personnel, since discharge of phenols, oxidizing agents, and settleable solids is far in excess of that expected by company officials.

In regard to the Shawinigan Resins Corporation and the Monsanto Chemical Corporation (Safiex Division), the wastes from these two plants are discharged to the Detroit River from a common lagoon. During the survey the only waste constituents considered excessive were BOD and suspended solids (originating primarily from Shawinigan Resins). The planned installation of a new lagoon after the survey should reduce these levels considerably; therefore no recommendations for improvement are made at this time.

In regard to the Wyandotte Chemicals Corporation - North Plant, concentrations of chlorides, suspended solids, and settleable solids in the plant effluent were excessive. The contribution of chlorides in the amount of 1,300,000 pounds per day represents almost half the entire industrial loading to the Detroit River. The suspended and settleable solids loadings from this industry represent 35 percent of the total loadings to the Detroit

River from industrial sources.

The composition of the suspended solids (most of which are readily settleable) is mainly calcium carbonate. This chemical is only slightly soluble in water and will readily settle out in clarifiers. Sludge from this operation when discharged to the River will settle on the River and Lake bottom and interfere with aquatic life.

It is recommended that:

The industry continue investigation of satisfactory methods of disposing of chlorides, and alternate methods of disposal of concentrated brines, such as subsurface disposal.

In regard to the Wyandotte Chemicals Corporation - South Plant, heavily concentrated wastes are pumped from this plant to the waste beds of Fighting Island. The remainder of the plant effluent is discharged to the Detroit River and contains excessive concentrations of chlorides and suspended solids.

It is recommended that:

The industry continue investigation of satisfactory methods of disposing of chlorides and alternate methods of disposal of concentrated brines, such as subsurface disposal.

George L. Harlow

I will now be discussing the recommendations for industries and municipalities in the Raisin River area.

The maintenance of adequate levels of dissolved oxygen in the lower Raisin River is the mutual responsibility of all discharging oxygen-demanding wastes into the River. Each recommendation made in this regard is to be understood as part of this mutual responsibility, and no industry or municipality is singly responsible for achieving the recommended DO level.

Municipal Waste Treatment

In regard to the Monroe Sewage Treatment Plant, two surveys revealed an influent fairly typical of a weak domestic waste. Exceptions to this general observation include high concentrations of soluble and total phosphates and certain toxic metals, including copper, zinc, and lead. These constituents were present in approximately the same concentrations in the plant effluent.

Plant efficiency, as measured by percent removal of suspended solids and BOD, was very good for a primary sewage treatment plant. Bacterial control was effective during the first survey when the effluent was chlorinated but poor during the second survey when it was not. Study of operating records revealed that similar degrees of plant efficiency were maintained on a long-term basis. The operation of this plant is considered outstanding for an installation of this type, and the operating personnel are commended.

It is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/l. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be operated at levels capable of providing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml. during the months of April through November.

3. The current plan of separating roof run-off from sanitary wastes to prevent overloading plant facilities be accelerated.

MR. STEIN: Mr. Har[illegible] before you go on, I wonder if you could clarify this.

In the Monroe Sewage Treatment Plant, you say the "removal of suspended solids and BOD was very good for a primary sewage treatment plant."

Then you say "Bacterial control was effective during the first survey when the effluent was chlorinated but poor during the second survey when it was not."

The next sentence is: "Study of operating records revealed that similar degrees of plant efficiency were maintained on a long-term basis."

Do you mean to say that the bacterial control was good or bad on a long-term basis?

MR. HARLOW: The degrees of plant efficiency ~~were~~ maintained on a long-term basis is on the basis of suspended solids and BOD.

MR. STEIN: Nothing to do with bacteria?

MR. HARLOW: Nothing to do with bacteria. The reason that the bacteria control, of course, was poor during some months of the year is because it is not chlorinated, as are none of the municipal effluents, except for the City of Detroit.

MR. STEIN: I understand you now. I got fooled by the preceding antecedent.

All right.

MR. HARLOW: In regard to the Consolidated Paper Company - North Plant, significant quantities of suspended solids, settleable solids, and BOD are discharged into the Raisin River and subsequently into Lake Erie. The wastes from this industry are equivalent in oxygen-consuming capacity to the untreated wastes from a population of over 100,000 persons, or approximately 45 percent of the total load to the Raisin River. Densities of coliform and fecal streptococcus organisms were also excessive.

In regard to the Consolidated Paper Company - South Plant, significant quantities and high concentrations of suspended solids, settleable solids, and BOD are discharged into the Raisin River and subsequently into Lake Erie. The wastes from this industry are equivalent in oxygen-consuming capacity to the untreated wastes of over 40,000 persons. Densities of coliform and fecal streptococcus organisms are unusually excessive, averaging over 1,000,000 total coliform organisms per 100 ml during the special survey.

In regard to the Monroe Paper Products Company, significant quantities and high concentrations of suspended solids, settleable solids, and BOD are discharged from this source into the Raisin River and subsequently into Lake Erie. The major portion of the suspended solids is readily settleable. Densities of coliform organisms were found to be excessive during the first survey at 32,400 organisms per 100 ml; however, during a separate Public Health Service survey several months later, the average coliform concentration exceeded 2,000,000 organisms per 100 ml.

In regard to the Union Bag-Camp Paper Company, River Raisin Division, significant quantities and high concentrations of suspended solids, settleable solids, and BOD are discharged from this installation to the Raisin River and subsequently into Lake Erie. The wastes from this industry are equivalent in oxygen-consuming capacity to the untreated wastes of 70,000 persons. A large part of the suspended solids was readily settleable.

In regard to these four paper plants just mentioned, it is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/l. Any plan for achieving this goal should include secondary treatment as a minimum.
2. Bacterial reduction facilities be provided and operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

In regard to the Ford Motor Company Plant on the Raisin River, the discharge from this plant represents 80 percent of the total waste volume from industrial sources discharged to the Raisin River and subsequently into Lake Erie. Cyanide concentrations and loadings in the plant effluent are excessive. The effluent from the company-owned sewage treatment plant is not chlorinated. The quantity of oil released to the Raisin River through a dilution canal outlet is excessive even though the concentration remains below 15 mg/l.

It is recommended that:

1. Bacterial reduction facilities be provided and operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.
2. Treatment facilities be operated to limit the cyanide concentration in the plant effluent to 0.025 mg/l.

In regard to the problem of overflows from combined sewers, although the severe effect of overflows from combined sewers upon water quality in the Detroit River and limited areas of Michigan Lake Erie was demonstrated, a specific method of approach to the solution of this problem is not now evident.

It is recommended to the Michigan Water Resources Commission that it require a detailed engineering study be made to determine costs and select an effective method of control. It is also recommended that a report of these investigations, containing the method to be used to solve this problem and a time schedule for accomplishment, be submitted within two years to the Secretary of Health, Education, and Welfare.

It is further recommended that agencies responsible for the current operation of combined sewer systems in the Detroit area immediately take steps to lessen the pollutional effects of malfunctioning overflow regulators by finding and correcting the cause of failure of these diversion devices and checking the operation of all overflows every day to determine if unnecessary overflows are occurring.

In regard to Federal Installations at the U. S. Naval Air Station, Grosse Ile, Michigan, it is recommended that:

1. A separator capable of producing an effluent containing less than 15 mg/l oil be installed on the line receiving aircraft washing wastes.

George L. Harlow

2. Operation of existing sewage treatment facilities be improved by performing such procedures as breaking up scum in gas vents, reversal of flow at periodic intervals, more frequent withdrawal of sludge, and daily scraping of the sides of the sedimentation chamber.

3. Better operation records be maintained.

4. Continuous and effective chlorination of plant effluent be practiced to assure that the geometric mean coliform density does not exceed 2,400 organisms per 100 ml.

5. The outmoded septic tank installation at the boat dock be replaced with an aerobic digestion treatment unit providing primary and secondary treatment followed by chlorination of the effluent.

6. If the U. S. Naval Air Station does not close on or before September 1, 1967, as scheduled, one of two alternatives be followed:

a. Connection to the municipal sewage collection and treatment system proposed for construction at Grosse Ile; or

Reproduced from best available copy.

b. Enlargement of the present naval facilities to include secondary treatment as proposed in the original plans.

At this writing the Navy has agreed to all of the foregoing recommendations and has already taken steps to accomplish all but the last recommendation.

In regard to the U. S. Coast Guard Station at Detroit River Light, it is recommended that a macerator-chlorination type treatment unit similar to those placed aboard motor launches be installed to the sanitary waste line now discharging raw sewage into Lake Erie.

In regard to the U. S. Corps of Engineers Dredging Operations, it is recommended that:

1. The hopper dredges discontinue disposing of the ships trash and garbage at the Raisin River dumping grounds.

2. Suitable treatment units be installed aboard ship to adequately dispose of all sanitary wastes including trash, garbage, and human excreta.

3. Closer control be exercised to minimize the loss of dredge material from the hoppers while proceeding to the dumping grounds.

4. A vigorous attempt be made by the Corps of Engineers to reduce the amount of dredging with action

leading to reduction of discharge of settleable material by increasing the charges to polluters for removing the material commensurate with the damages to water uses incurred. (It is believed that it was not the intent of Congress that such dredging operations should provide a method of disposal of solid material deposited by individuals or corporations in navigable streams.) It is desirable not only that dredged channels be maintained but that every means possible be taken to keep the cost of such maintenance to a minimum.

The District Engineer has agreed to take steps to see that the recommendations are put into effect. He reiterated that the Corps of Engineers does charge the polluters for removing the material commensurate with the damages to water uses incurred and that the Corps of Engineers does not have any statutory authority to prevent the original discharge of the material to the navigable waterway. He also stressed the responsibility of the Corps of Engineers in enforcing Federal legislation relative to discharge of waste materials from vessels into navigable waters.

To emphasize what is necessary to abate water pollution at Sterling State Park, the recommendations already given for waste sources of the Consolidated

Paper Company, the Monroe Paper Products Company, the Union Bag-Camp Paper Company, the Ford Motor Company, and the Monroe Sewage Treatment Plant on the Raisin River must be adhered to, but in addition, in the area north of Sterling State Park between Sandy Creek and Stony Creek, it is recommended that measures be taken to eliminate direct and indirect discharge of sanitary sewage to Lake Erie. It is also recommended that discharge of sanitary wastes to the storm pumping stations be eliminated.

Septic tanks tend to function poorly due to the nature of the soil and the high water table. It is recommended that shorefront communities having septic tanks and direct discharge installations be sewered and the wastes transported to a sewage treatment plant providing adequate treatment and chlorination.

Finally, it is recommended that the practice of allowing discharge of raw and septic tank effluent from the suburban area outside Monroe to surface drains be discontinued. This material is discharged into the Raisin River during heavy rainfall. It is further recommended that the area be sewered with sanitary wastes transported to a sewage treatment plant providing adequate treatment and chlorination.

This completes the presentation of the

Detroit River - Lake Erie Project of the Public Health Service.

MR. POSTON: On Page 3, would you care to elaborate on that?

MR. STEIN: When the report was given, possibly the greatest degree of controversy, in view of the repercussions, at least in my view, occurred in the next to the last paragraph on Page 3.

Do you want to read that?

MR. HARLOW: I will read this.

MR. STEIN: I would suggest that you read it, so that we know what the issue is.

MR. HARLOW: I will be reading on Page 3.

MR. STEIN: This is part of the general conclusions dealing with the whole area; is that correct?

MR. HARLOW: Yes.

MR. STEIN: All right, go ahead.

MR. HARLOW: The general conclusions did contain recommendations, and I will read it.

All municipal sewage treatment plants in the area currently practice primary treatment followed by chlorination. In order to protect water uses, municipal treatment facilities are to be provided capable of producing an effluent not to exceed:

1. Suspended solids concentration of 35 mg/1
2. Settleable solids concentration of 5 mg/1
3. Ammonia concentration of 2 mg/1
4. Phenol concentration of 20 micrograms per liter.
5. Oil concentration of 15 mg/1
6. Biochemical oxygen demand of 20 mg/1
7. Bacterial densities, monthly geometric mean, of 5000/100 ml. It is recommended that all municipalities provide a minimum of secondary treatment plus adequate chlorination to maintain these standards.

Recommendations for abating pollution interfering with water use -- I don't need to repeat that statement. It was said before.

MR. STEIN: As I understand it, you have made specific recommendations as to the municipalities and for each industry?

MR. HARLOW: Yes.

MR. STEIN: What you have just read relates to all municipalities?

MR. HARLOW: That's right.

MR. STEIN: What do you mean when you say "Plus adequate chlorination"? Do you mean chlorination all year round by that, or not?

MR. HARLOW: For the Detroit Sewage Treatment Plant, I am recommending chlorination all year round.

For the other municipal waste treatment plants, the recommendation is for disinfection of the effluent, and I include the months of April through November.

MR. STEIN: As far as I am concerned, this clarifies what you said.

Do you have any questions, or do you want to hold them for a while?

MR. OEMING: Mr. Chairman, I have a series of questions that I would like to ask either Mr. Vaughan or Mr. Harlow to clarify many points in the report that are not clear to me, and for the guidance of the State here in the future.

I would ask that we be permitted to defer these questions until perhaps the morning session.

I have, however, one comment to make here. I noticed, in following the verbal presentations by Mr. Vaughan and Mr. Harlow, that there have been some departures from the text of the report. Some of them are minor. Some of them are apparently additions to the report that they wished to include.

I would ask you to rule as to whether the written report controls, or, putting it another way, if there are changes in this report, that they be made clear as to where those changes are?

MR. STEIN: I think the verbal presentation controls. We take the man's last report and what he thinks is relevant, and accept it.

I have no objection to including in the record those paragraphs that they have omitted where there is no change, but where they have made a change, I think the verbal presentation should control.

As part of the development of the data in the case, the Conferees should point these out and go over them very, very carefully, so that there would be no ambiguity on any points as to what these may mean.

MR. OEMING: One more point. Where there are additions made to the report, does this also apply that the additions will be made?

MR. STEIN: Yes. The additions do control as far as their report is concerned. Anything that they have added controls.

For myself, and this is why I raised the questions that I did, I think I understood what they said. However, I do think that if there is any ambiguity in anyone's mind among the Conferees of what Mr. Vaughan and

Mr. Harlow said, these points should be clarified with questions.

MR. OEMING: As to the clarifying questions, Mr. Chairman, do I understand that this meets with your approval, that we take those up the first thing in the morning?

MR. STEIN: I will be delighted to do that.

(The Report on Pollution of the Detroit River, Michigan Waters of Lake Erie, and their Tributaries, Summary, Conclusions, and Recommendations, as originally submitted, is as follows.)

George L. Harlow

Report on Pollution of the Detroit River, Michigan Waters of Lake Erie, and their Tributaries

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

CONCLUSIONS

Every day more than 1.6 billion gallons of waste water flow into the Detroit River -- 1.1 billion gallons from industry and 540 million gallons from municipal sewage. Hugh quantities of waste products contained in this discharge change the Detroit River from a basically clean body of water at its head to a polluted one in its lower reaches. These waters are polluted bacteriologically, chemically, physically, and biologically, and contain excessive coliform densities as well as excessive quantities of phenols, iron, oil, ammonia, suspended solids, settleable solids, chlorides, nitrogen compounds, and phosphates. Pollution of the Detroit River will become progressively worse unless effective action is taken immediately.

The City of Detroit's main sewage treatment plant, serving more than 90 percent of the people in the Project area, contributes 95 percent of the municipal waste to the Detroit River and is also the major source of suspended solids, phenols, oil, inorganic nitrogen, phosphates, and biochemical oxygen demand in the river. Overflow from combined sewers in Detroit and its suburbs, carrying both stormwater and raw sewage, contributes greatly to the degradation of the river.

In the upper Detroit River, the Great Lakes Steel Co. and the Allied Chemical Corp. are the major sources of industrial wastes. The Ford Motor Co. is the principal contributor of inorganic wastes to the Rouge River, and the Scott Paper Co. is the principal contributor of organic wastes. Downriver industries contributing significant quantities of wastes are the Great Lakes Steel Corp., the McLouth Steel Corporation, Pennsalt Chemical Corporation, and Wyandotte Chemical Corporation. On the Raisin River the leading polluters are the two Consolidated Paper Company mills, Monroe Paper Products Company, and the Union Bag-Camp Paper Company.

Other significant sources of pollution in the study area are overflows from combined sewers, municipal and industrial waste spills, and wastes from shorefront homes.

George L. Harlow

Pollution of the Detroit River causes interference with municipal water supply, recreation, fish and wildlife propagation, and navigation. Two municipal water intakes, particularly that of Wyandotte, are endangered by the high bacterial counts of the river, and the rising chloride levels indicate potential future problems for industrial water usage. In addition, high concentrations of phenols and ammonia at the Wyandotte water intake have interfered with municipal water treatment by causing taste and odor problems and reducing the effectiveness of chlorination. Excessive quantities of chlorine are needed to reduce bacteria to a safe level.

All forms of water contact sports in the lower Detroit River are hazardous. Declining levels of dissolved oxygen in the lower Detroit River as it enters Lake Erie are approaching the danger point, indicating trouble in the future unless appropriate remedial action is taken. Together with bottom sludge deposits, oils, and toxic materials, they threaten fish, migratory birds, and other wildlife. In order to maintain navigation, extensive annual dredging is required at the junction of the Detroit and Rouge Rivers and at the mouths of the Detroit and Raisin Rivers to remove deposits of suspended solids in large part originating in municipal and industrial waste discharges.

George L. Harlow

About 6 million pounds of waste products are discharged every day from U.S. industries and municipalities to the Detroit River. 20 million pounds of measured waste constituents are discharged every day from U.S. water of the Detroit River to Michigan waters of Lake Erie. The Raisin River, grossly polluted at its mouth, also pollutes the Michigan waters of Lake Erie.

The Michigan waters of Lake Erie have two major zones of pollution -- one in the vicinity of the mouth of the Detroit River, and one near the mouth of the Raisin River.

Bacteriological densities in the Lake from the mouth of the Detroit River to a point 2 or 3 miles south make the water unfit for recreational use; following heavy rainfall in the Detroit area, this zone is extended southward to Stony Point. The periodic contamination of Sterling State Park beaches, which are posted as unsafe for swimming, is caused by wastes from the Raisin River and septic tank discharge.

Concentrations of chlorides, metals toxic to fish life in minute concentrations, and suspended solids in the lake portend future problems in various water uses. Composition of bottom organisms in the Detroit River changes from a pollution-sensitive population typically found in clean waters to a predominantly pollution-tolerant population in the lower River.

Pollution-stimulated algal growths have forced Monroe to move its water intake point to avoid unpleasant tastes and odors in the water, and algal blooms near the new intake again threaten to degrade Monroe's drinking water. Discharges of nutrients and organic wastes into the Michigan part of Lake Erie have speeded the enrichment of that portion of the Lake.

Water at Sterling State Park is erratically polluted, and this area occasionally had coliform counts exceeding 100,000 organisms per 100 ml, and the recommendations in this report are based on that standard. The Raisin River was discovered to be the primary cause of this pollution; when Lake currents are northerly (40 to 45% of the time), polluted Raisin River water is carried directly to the beaches. When currents are southerly, polluted drainage from septic tanks reaches the Park. To improve water quality at Sterling State Park, these sources of pollution must be controlled.

Adverse effects of stormwater overflow on water quality were seen in all the waters studied by the Project. During and after heavy rainfall, sewage plants must bypass untreated wastes directly to the rivers, and this can occur on 33 to 45 days a year. The overflows averaged 8.2 hours and have lasted as long as 24 hours, and the detrimental effects from a single storm have lasted as long as 5 days. Bacteria in storm overflows ofen approached the densities found in raw sewage, with counts as high as high as 100 million per 100 ml. Storm-caused overlows alone are responsible for the discharge of 5 billion gallons of raw sewage to the Detroit River yearly.

While there is some evidence that water quality is improving, because of increased water uses damages are increasing, and unless remedial action is taken immediately the usefulness of the water resources of the Detroit area may be destroyed completely by pollution.

All municipal sewage treatment plants in the area currently practice primary treatment followed by chlorination. In order to protect water uses, municipal treatment facilities are to be provided capable of producing an effluent not to exceed:

1. Suspended solids concentration of 35 mg/1
2. Settleable solids concentration of 5 mg/1
3. Ammonia concentration of 2 mg/1
4. Phenol concentration of 20 micrograms per liter
5. Oil concentration of 15 mg/1

6. Biochemical oxygen demand of 20 mg/l

7. Bacterial densities, monthly geometric mean, of 5000/100 ml. It is recommended that all municipalities provide a minimum of secondary treatment plus adequate chlorination to maintain these standards.

Recommendations for abating pollution interfering with water use in the Detroit River and Michigan Lake Erie are made in two categories: general recommendations relating to the Project area, and specific improvements required at each waste source contributing to the polluted condition of the waters. In addition to these recommendations designed to abate existing pollution, the report points out many areas where additional improvement in water quality will aid in the prevention of future problems.

INTRODUCTION

A water pollution investigation of the Detroit River and the Michigan waters of Lake Erie has been made by the personnel of the Detroit River-Lake Erie Project of the Public Health Service, U.S. Department of Health, Education, and Welfare, under the authority of section 8 of the Federal Water Pollution Control Act as amended

(33 U.S.C. 466 et seq) and at the request of the conferees of the Federal-State conference on water pollution held in Detroit, Michigan, on March 27 and 28, 1962.

The investigation was conducted to fill the gaps in existing technical information on water quality, sources and quantities of wastes, and the extent of pollution in the United States waters of the Detroit River and the Michigan waters of Lake Erie. The investigation was conducted in cooperation with the State regulatory agencies. The valuable assistance and special participation of personnel of the Michigan Department of Health is recognized. Assistance was also rendered by the Corps of Engineers, U.S. Geological Survey, and the International Joint Commission.

Intensive surveys were made of 6 municipal and 42 industrial waste sources to ascertain their individual contributions to the waste loadings in the waters under study. These surveys were joint efforts of the Project and the appropriate State regulatory agency. In the area of industrial waste surveys, Michigan Water Resources Commission personnel collected the samples and, after analysis by the Project, the Commission evaluated the findings and made recommendations where appropriate. In some cases the Project personnel made additional recommendations.

George L. Harlow

A cooperative study was undertaken with the Michigan Department of Health and the Michigan Water Resources Commission to determine and compare the characteristics of overflows from combined sewers with those from separate storm sewers.

Generally, laboratory procedures were performed in accordance with "Standard Methods for the Examination of Water and Wastewater, Eleventh Edition." Any deviations were based on proven research described in the literature.

The main body of this report contains a narrative description of all major activities of the Project, accompanied by appropriate maps, graphs, and tables. All tables and figures are contained in the seven sections which constitute the main body of the report.

SUMMARY OF FINDINGS - DETROIT RIVER

Water Uses

The Detroit River is actually a strait connecting the waters of Lake St. Clair to those of Lake Erie. Its average discharge, based on United States Lake Survey records through April 1964, is 182,000 cubic feet per second. During the study period the discharge averaged 170,000 cubic feet per second.

George L. Harlow

The water uses of the Detroit River are as follows:

1. Shipping and navigation. Tonnage shipped through the Detroit during the recent eight-month season exceeded the entire combined tonnage shipped through the Suez and Panama Canals during an entire year. To maintain navigation, dredging operations are carried on in the Detroit River and Lake Erie by the U.S. Corps of Engineers.

2. Major staging area for migrations of waterfowl. Estimated winter populations since 1950 ranged from a minimum of 5,000 in 1961-1962 to 100,000 in 1963-64.

3. Recreation. There are at least 18 recreational areas and 63 marine facilities in the study area.

4. Water supply. Heavy use is made of the Detroit River for municipal and industrial water supply. The major municipal user is the City of Detroit, serving the water supply needs of over three million people both in Detroit and adjacent communities. Three municipal water supply intakes serving the Detroit area are located in the U.S. section of the Detroit River.

5. Sport Fishing. The fish of the Detroit River and adjacent waters of Michigan Lake Erie are a valuable natural resource providing recreation for many anglers in the metropolitan area. Sales of bait, tackle,

and fishing gear as well as sales and rentals of boats and motors to sportsmen constitute a business activity of considerable economic importance to the area.

Description of Water Quality and Interference with Water Uses

Several prior investigations concerning water quality in the Detroit River have been made by government agencies and private consulting engineering firms during the last 50 years. Reports of these investigations show the progressive deterioration of the Detroit River water quality from headwaters to mouth due to municipal and industrial waste discharges. Comparison of waste loadings discharged to the Detroit River during the 1948 IJC survey and the 1963 Public Health Service survey reveals over 50 percent reduction in phenols, cyanide, oil, and suspended solids from industrial sources during the 15-year period.

The water quality of the Detroit River from its head to its junction with the old channel of the Rouge River (approximately 10 miles downstream) is satisfactory during dry weather conditions. During overflows from combined sewers, the only part of the Detroit River free from pollution is the stretch above Conners

Creek and midstream down to the Rouge River.

From their points of discharge all types of wastes had a tendency to hug the United States or Canadian shores and then slowly extend outward into the main body of the river. Thus the pollution is not as great in the middle of the River.

Bacterial Density. High total coliform densities, especially when accompanied by high fecal coliform densities, indicate the presence of animal (including human) wastes which may contain pathogenic organisms capable of causing enteric diseases in humans. The presence of these organisms above acceptable levels is a threat to the health and welfare of those who use this water for domestic water supply and recreational purposes. A widely used standard for swimming is 1,000 organisms per 100 ml.

Bacterial densities differed greatly between dry and wet weather conditions. During dry conditions the geometric mean coliform density in the upper Detroit River was under 500 organisms per 100 ml., with average values at the headwaters under 100 organisms per 100 ml. Below Zug Island and the Rouge River the geometric mean coliform densities increased to values exceeding 5,000 organisms per 100 ml. During wet conditions no change was noted at the head of the Detroit River, but below Conners Creek geometric means rose to approximately 7,000 per 100 ml. in the upper River and to over 80,000 in the lower Detroit River. During wet and dry weather almost all of the lower Detroit River has geometric mean values in excess of 2,400 organisms per 100 ml., and most of the lower Detroit River exceeds 5,000 organisms per 100 ml. during wet conditions.

Fecal coliform ration to or percentage of total coliforms provides additional information on water quality. The range noted during the study was 30 to 90 percent of the total coliform densities, with higher values observed in the lower Detroit River during wet conditions. Fecal streptococci were generally less than either total or fecal coliforms.

Geometric mean densities depict only average conditions and tend to mask extremely high values. These high values can indicate significant effects on many water uses, especially those affecting human health and welfare. Maximum values during the survey ranged from 4,900 organisms per 100 ml. at the headwaters to 770,000 organisms per 100 ml. in the lower River.

At the head of the Detroit River average total coliform densities were approximately the same during wet and dry conditions throughout the range. At all locations from just below Belle Isle to the mouth of the Detroit River average coliform densities near the United States shore during wet conditions were 5 to 10 times higher than corresponding values during dry weather. Study of the results of sampling in the Detroit River by personnel of the City of Detroit during the past four years indicates a pronounced downward trend (as evidenced by median values) in coliform densities in American waters near the shore, especially during the years 1962 and 1963.

Effluents from the main Detroit Sewage Treatment Plant, Wyandotte Sewage Treatment Plant, and overflows from combined sewers are significant sources of coliforms, fecal coliforms, and fecal streptococci to the Detroit River.

Four years of operating records of several area water and sewage treatment plants were evaluated. These records indicate a substantial reduction in monthly geometric mean coliform densities during 1962 and 1963 compared with the preceding two years, especially in the Detroit Sewage Treatment Plant effluent. A corresponding reduction in coliform density at the Wyandotte Water Treatment Plant was observed in these two years. Little change was noted in suspended solids in sewage effluent or influent in area plants during the period.

George L. Harlow

Monthly geometric mean values in several Detroit River sewage treatment plant effluents indicate substantial reduction during the past few years. During certain months with geometric mean values under 20,000 organisms per 100 ml., densities of daily samples varied widely, with daily averages frequently over 100,000 per 100 ml. Such erratic control of coliform organisms is not considered unusual when chlorination is practiced following primary sewage treatment.

Pollution from partially treated municipal wastes and overflows from combined sewers endangers the users of the domestic water supplies from the Wyandotte intake and, at times, users of the domestic water supplies from the Southwest intake of the City of Detroit in the event of a breakdown in the water treatment facilities. Pollution from these sources also interferes with recreational uses at all times in the lower Detroit River. Pollution originating from the Detroit and Wyandotte Sewage Treatment plants and combined sewers along the entire shoreline of the River must be abated to improve water quality and increase the uses of the Detroit River.

BOD and DO. Insufficient dissolved oxygen in water can kill fish and other aquatic life or prevent their propagation. Low levels of dissolved oxygen can cause objectionable odors and thus interfere with recreation and aesthetic enjoyment.

Dissolved oxygen in the upper River is stable at 93 - 106 percent of saturation, but gradually diminishes to an average saturation of 67 percent at the mouth in that section of the River most affected by the Trenton Channel. The minimum observed value during the survey was 5.1 mg/l at the mouth.

The major sources of biochemical oxygen demand (BOD) are the effluents of the main Detroit Sewage Treatment Plant and the Scott Paper Company on the Rouge River.

While the present oxygen level in the lower Detroit River does not cause major interference with water uses, the drop from 100 percent saturation in the upper River to 67 percent in the lower is a warning of dire consequences in the future unless appropriate action is taken and represents a threat to water uses in the Detroit River and Michigan Lake Erie.

Suspended and Settleable Solids. Excessive amounts of suspended solids in water can cause interference with domestic and industrial water treatment processes, harmful effects to fish and other aquatic life by clogging the gills and respiratory passages of aquatic fauna, turbidity which interferes with light transmission, and can

George L. Harlow

interfere with boating and aesthetic enjoyment of the water. When a part of the suspended solids settles out on stream and lake bottoms as sludge or bottom deposits, damage to aquatic life can occur since these deposits blanket the bottom, killing eggs and essential fishfood organisms and destroying spawning beds. When the suspended solids carry with them toxic material, aquatic life can be killed when the toxic materials leech out into the water above.

A substantial increase in suspended solids occurred in the Detroit River from its head to mouth with a range of 5 - 20 mg/1 in the upper and 14 -65 mg/1 in the lower river. Setteable solids showed a similar increase from a range of 5 - 10 mg/1 to 10 - 24 mg/1.

The largest contributor of suspended and settleable solids is the Detroit Sewage Treatment Plant. The Wyandotte Chemical Company is also a significant contributor of suspended and settleable solids.

Sludge banks are present and are particularly extensive near the mouth of the River as it empties into Lake Erie. These deposits of sludge are primarily due to suspended and settleable solids in municipal and industrial wastes discharging into the Rouge and Detroit Rivers. The bottom deposits caused by pollution create unfavorable environmental conditions for the propagation of game fish. Sludge deposits along the shoreline and in marinas interfere with recreational use and the aesthetic enjoyment of water. Pollution in the form of these deposits interferes with navigation, requiring annual dredging operation to maintain channels, marinas, and harbor facilities.

Oil and Grease. Oil and grease were repeatedly observed in the Detroit River.

The major sources of oil are the main Detroit Sewage Treatment Plant effluent and several industrial sources.

Although good oil pollution control has been effected by the State regulatory agencies during wildfowl over-wintering periods, the continued presence of excessive quantities of this pollutant in waste effluent poses a constant threat to fish and wildlife, as well as interfering with recreational use of the water. Oil spills were observed during the study period by the Project.

Phenols. High levels of phenols in waters cause disagreeable taste and odors in drinking water, tainting of flesh in game fish, and may even result in fish kills when concentrations are excessive. Phenols are present in Detroit raw water supplies in sufficient concentration to cause disagreeable tastes and odors, and expensive water treatment procedures are required to eliminate the problem. Average phenol concentrations should not exceed 10 micrograms per liter in the lower River, and 6 - 9 micrograms per liter at the mouth. Average phenol concentrations at all ranges in the Detroit River exceeded recommended levels during the survey. Records of the International Joint Commission indicate high concentrations in the St. Clair River below known sources of phenolic wastes in Sarnia, Ontario, Canada.

The major sources of phenols are the main Detroit Sewage Treatment Plant effluent, which treats the wastes of numerous industries, and other industrial sources.

Excessive phenol concentrations in the waters and bottom muds of the Detroit River pose a threat to fish and other aquatic life and have interfered with domestic water treatment at the Wyandotte plant.

Chlorides. Chloride concentrations above certain levels can interfere with domestic and industrial water supplies by causing objectionable tastes in drinking water and corrosion in industrial processes.

Chlorides in the Detroit River increased from uniform concentrations of 7 - 10 mg/l at the head to average values ranging from 9 - 69 mg/l at the mouth. High values were observed in the Trenton Channel and at the mouth near the United States shore.

The principal contributors of chlorides to the Detroit River are the Allied Chemical Corporation, Pennsalt Chemical Company, and the Wyandotte Chemical Company.

Increases in chloride concentrations indicate a change in the mineral content of the Detroit River from head to mouth. Although these concentrations are not yet significant enough to cause major interference with water use, the doubling of chloride loadings in a 30-mile stretch of the river is of concern. Future action may be necessary to prevent an undesirable situation.

Iron. Excessive concentrations of iron in water may cause interference with domestic and industrial water supplies. Iron is toxic to certain species of fish and other aquatic life in relatively low concentrations. Iron concentrations should not exceed 0.3 mg/1 (ppm) in the receiving stream to prevent interference with municipal and industrial water supply and to protect fish and wildlife.

Average iron concentrations in the Upper Detroit River meet recommended levels, but downstream the concentrations increase to average values of 0.52 mg/1. The iron concentration at the mouth ranges from 0.47 - 0.63 mg/1.

Although the Detroit Sewage Treatment Plant is a significant contributor of iron to the Detroit River, the largest sources of iron are the Great Lakes Steel Company and the Ford Motor Company.

Iron concentrations in the waters and bottom muds of the Detroit River pose threats to fish and other aquatic life and represent a potential interference with industrial water supply.

Nitrogen. Nitrogen compounds coupled with phosphorus can act as essential nutrients causing the growth of algae in bodies of water where other environmental factors are satisfactory. In small quantities these algae are desirable as a major source of food for fish. When algal growth exceeds certain limits, nuisances result from the blooms. They are unsightly, can result in obnoxious odors, and some species can be toxic to fish. The level of inorganic nitrogen compounds (nitrates, nitrites, and ammonia) above which undesirable blooms can be expected to occur is 0.30 mg/l.

Nitrogen compounds show a significant increase from the head to the mouth of the River. Inorganic nitrogen (nitrates, nitrites, and ammonia) increased from approximately 0.2 mg/l at the head to over 0.4 mg/l at the mouth of the River. Ammonia increased dramatically below the

Rouge River and Zug Island from a range of 0.08 - 0.14 mg/l to 0.16 - 0.41 mg/l. High ammonia levels at the Wyandotte water treatment plant, causing a variable chlorine demand, have necessitated greated chlorine dosages to assure a safe supply at all times. The presence of this material not only results in additional expense but also represents an interference with the effectiveness of chlorine in disinfecting water supplies, and thus is a potential hazard to the health and welfare of the users. High ammonia levels can be expected to cause similar problems at the new southwest intake operated by the City of Detroit.

The main source of nitrogen to the Detroit River is the effluent of the main Detroit Sewage Treatment Plant.

Essential nutrients for plant growth, including inorganic nitrogen compounds and phosphates, increase significantly from the headwaters to the mouth of the Detroit River. Excessive concentrations of these constituents cause interference with almost all legitimate water uses.

Phosphates. Soluble phosphates in relatively small concentrations are readily available as an essential plant nutrient. The insoluble portion of the total phosphate concentration can be converted to the soluble form and thus become available for such plant utilization. Soluble phosphates present in greater concentrations than 0.015 mg/l, reported as phosphorus, in combination with inorganic nitrogen compounds in excess of 0.30 mg/l with the highest value located near the United States shore just downstream from the combined sewer outfall at Conners Creek. These values increased to a range of 0.176 to 0.204 mg/l at the mouth.

The main source of phosphates to the Detroit River is the main Detroit Sewage Treatment Plant effluent.

Biology. The waters of the Detroit River from head to mouth were found to contain low numbers of planktonic algae, with counts averaging 500 per ml. Low densities of animal plankton were also found. Plankton entering the river with water masses from Lake St. Clair were carried as a "standing crop" downriver to Lake Erie with little change in density or species composition either vertically or horizontally across the river. The rate of travel is too rapid for the domestic and industrial wastes to appreciably alter the number of plankton.

The bacterial slim Sphaerotilus was found, attached to bridge abutments, pilings, piers, buoys, etc., in abundant quantities in the Detroit River below the Rouge River and Detroit Sewage Treatment Plant outfall.

George L. Harlow

Composition of bottom organisms in the Detroit River changed from a pollution-sensitive population typically found in clean waters to a predominantly pollution-tolerant population in the lower areas of the River below Zug Island and the Rouge River. This change was especially pronounced along the United States shore. In the reach of the Detroit River from Zug Island to the mouth, habitats suitable for the support of a variety of bottom organisms have been destroyed by the deposition of organic solids and oils, especially in areas nearest the Michigan shore.

Clinging and burrowing mayfly nymphs, both pollution-sensitive organisms associated with clean bottom conditions, in themselves valuable as fish food, were found in the upper ranges of the Detroit River but were completely absent from the River below the Rouge River and Detroit Sewage Treatment Plant and in the entire Michigan waters of Lake Erie. Habitats in the lower Detroit River formerly suitable for the support of this once-abundant organism have been totally destroyed by pollution.

Sources and Characteristics of Wastes

A total municipal waste volume of 540 million gallons is discharged daily into the Detroit River, containing the following loadings of constituents:

1. Wastes equivalent in oxygen-consuming capacity to raw sewage from a population of over 3,000,000.

2. Innumerable coliform bacteria.

3. Over 25,000 pounds of iron.

4. Over 600,000 pounds of suspended solids and almost 300,000 pounds of settleable solids.

5. Over 16,000 gallons of oil.

6. Over 1,200 pounds of phenolic substances.

7. Over 34,000 pounds of ammonia.

8. Over 150,000 pounds of total phosphates, including 70,000 pounds of soluble phosphates.

9. Over 500,000 pounds of chlorides.

A total industrial waste volume of 1.1 billion gallons is discharged daily into the Detroit River, containing the following loadings of constituents:

1. Wastes having an oxygen-consuming capacity equal to raw sewage from a population of over 1,000,000.

2. Over 3,000 gallons of oil.

3. Over 800,000 pounds of suspended solids, of which almost 700,000 are settleable.

4. Over 1,400 pounds of phenols.

5. Over 8,000 pounds of ammonia.

6. Over 80,000 pounds in iron.

7. Over 2 million pounds of chlorides.

8. Over 200,000 pounds of acid.

Stormwater Overflow Studies

Studies were performed jointly with the Michigan Department of Health and the Michigan Water Resources Commission to compare the characteristics of discharges from the combined sewers serving the City of Detroit (Conners Creek system) and the separate storm and sanitary sewers serving Ann Arbor, Michigan.

The following is a summary of waste constituents found in the stormwater overflows from combined sewers:

1. Total coliform, fecal coliform, and fecal streptococcus densities many times approached values found in raw sewage. Coliform counts of over 100,000,000 organisms per 100 ml were found during summer months. Lower results were found in the winter.

2. Total coliform densities in the separate stormwater system at Ann Arbor regularly exceeded 1,000,000 organisms per 100 ml. Average total coliform densities from the Detroit combined system were approximately 10 times higher than those in the Ann Arbor separate system. Fecal coliform densities were found to be approximately 30 times greater than similar values in the separate system, while comparable fecal streptococcus levels were at least

twice as high.

3. Phenol, BOD, phosphate, ammonia, and organic nitrogen concentrations were two to five times higher in the combined overflow than in the separate storm discharge.

4. In the Detroit area, rainfall sufficient to cause overflows from all combined sewers (0.3 inch) can be expected to occur approximately 33 days each year. Rainfall sufficient to cause overflows from certain parts of the system (0.2 inch) can be expected to occur about 45 days each year.

5. Calendar years 1963 was the driest on record for the City of Detroit according to rainfall records of the U.S. Weather Bureau. Even during this year, the Conners Creek pumping station was observed to overflow 12 times during a 6-month period in 1963. During the first 12 months of operation of the automatic sampler, the Conners Creek installation overflowed and collected samples 23 separate times. Both figures exclude the period of raw sewage bypass from this station by the City of Detroit.

6. The volume of overflow at the Detroit installation during the survey varied from 40 million gallons to 509 million gallons. The greatest volume was observed during the overflow of longest duration. This

volume, which originated from only 25 percent of the City of Detroit, is approximately the same as the daily discharge of partially treated sewage from all sewage treatment plants into the Detroit River.

7. Volume figures indicate a discharge into the Detroit River of 4½ billion gallons from the combined sewers serving the Conners system during the first year of operation of the sampling station.

8. It is estimated that 2 percent of the total raw sewage contributed to the Detroit area sewers reaches the Detroit River each year. This is over 5 billion gallons of raw sewage contributed to the Detroit River from this source each year. This figure should be considered conservative since the Conners system is designed for more storage capacity than many other combined sewers in the Detroit and downriver collection systems.

Total bacterial densities were found to increase from the head waters to the mouth during a typical overflow. The following is a summary of data on bacterial densities:

1. Coliform, fecal coliform, and fecal streptococcus densities increased in the Detroit River, following an overflow from combined sewers, 10 to 50 times over the values found during dry weather conditions.

2. Coliform densities in the Detroit River

following an overflow often exceeded 300,000 organisms per 100 ml and at times exceeded 700,000 organisms per 100 ml.

3. All high bacteriological values in the Detroit River during or following an overflow were found below Conners Creek. Bacteriological densities above this point stayed fairly constant during wet and dry conditions. Conners Creek represents the farthest upstream location on the Detroit River of many combined sewer outfalls.

4. City of Detroit sampling records show individual values exceeding 800,000 organisms per 100 ml in the Detroit River on the day following significant rainfall.

5. High bacteriological densities following overflows were found at both the City of Wyandotte water intake and the new intake of the City of Detroit near Fighting Island. The Wyandotte values exceeded 100,000 organisms per 100 ml and the Fighting Island values 10,000 organisms per 100 ml.

6. Rainfall,overflow, and stream quality records show that during a 9-month period in 1963 (March-November) overflows from combined sewers affected water quality in the Detroit River during part or all of 88 days. This represents 32 per cent of the days in the 9-month

period. This phenomenon occurred during the year of lowest accumulated rainfall and implies an even greater effect on Detroit River water quality during a year of normal rainfall.

During heavy rains causing overflow, visual observations were made of the Detroit River by Project field personnel, who noted condoms, debris, and garbage as well as excrement floating down the River.

Special Studies

Several special studies were conducted by the Project to provide additional information on complex problems. The following were investigated:

1. The effect of pollution originating from unsewered homes or from inadequately functioning installations on Gross Ile.

2. Growth and die-off of bacteria in the Detroit River.

3. Bypass of 75 MGD of raw sewage for 10 consecutive days by the City of Detroit during November 1963.

4. Detroit's bypassing of treated effluent through an alternate outfall to the Rouge River and its

adverse effect on water quality in the lower Detroit River.

6. Distribution of flow in the Detroit River by dye tracer studies.

7. Tributaries of the Detroit River thought to be of significance in the contribution of industrial or domestic wastes and subsequent deterioration of the main river.

Detailed information on the results of these studies can be found in Section V in the main body of the report.

Interferences with Water Uses

Municipal Water Supply. Two municipal water intakes in the Detroit River, the Southwest City of Detroit intake and the Wyandotte intake, receive water with bacterial counts frequently high enough to pose a health hazard in the event that water treatment facilities should malfunction. Furthermore, ammonia levels at the Wyandotte intake are high enough to lessen the effectiveness of normal disinfection procedures, and phenols cause taste and odor problems.

Industrial Water Supply. The water supply of several industries is interfered with by high chloride concentrations in the Detroit River, but the Project staff was unable to obtain statements to this effect from the industries concerned.

Recreation. Pollution has necessitated that all beach areas on the Detroit River below Belle Isle be posted as unsafe for swimming and other water-contact sports. Thus 26 out of the 31 miles of the Detroit River have had their recreational usefulness greatly diminished. At the same time, many people ignore the warnings of State and local health authorities, and swim and water-ski in the restricted area. For these people, pollution in the River presents an immediate health hazard. Boaters and owners of marinas along the lower River are constantly harassed by oil slicks and sludge deposits, which deface boats and boat equipment, fill in and foul docking facilities, and create an aesthetic nuisance.

Fish and Wildlife Propagation. Creel census records indicate a change in the predominant types of fish in the Detroit River from a variety of desirable game fish to a predominance of carp and yellow perch. The destruction of 10.000-12,000 wildfowl four years ago has been attributed to oil pollution.

Navigation. Sludge deposits at the junction of the Rouge and Detroit Rivers and at the mouth of the Detroit River require extensive annual dredging by the

U.S. Army Corps of Engineers to maintain routine navigation.

SUMMARY OF FINDINGS - LAKE ERIE

This study was limited to the Michigan waters of Lake Erie, which constitute approximately 1 percent of the surface area of this international body of water. Lake Erie is the shallowest of all the Great Lakes, and the greatest recorded depth in its Michigan waters is only 29 feet. Most of the water flowing into Lake Erie is from the Detroit River.

Description of Water Quality

The Michigan waters of Lake Erie have two major zones of pollution -- one in the vicinity of the mouth of the Detroit River, one near the mouth of the Raisin River. These waters are polluted bacteriologically, chemically, physically, and biologically; they contain excessive coliform densities, suspended solids, nitrates, ammonia, organic nitrogen and phosphates, and sludge deposits.

Bacterial Density. Sewage commonly contains many pathogenic organisms that can cause gastrointestinal diseases, eye, ear, nose and throat disorders, skin infections, and hepatitis when ingested. These organisms may include both bacteria and viruses. They are usually measured by counting the number of coliforms (bacteria particularly associated with human or animal excreta).

The maximum density of coliform bacteria recommended in this report - 1,000 organisms per 100 ml. - is exceeded for 2 to 3 miles south of the mouth of the Detroit River and for approximately 1 mile out from the mouth of the Raisin River. Maximum coliform values showed a similar pattern of dispersion, with individual values exceeding 100,000 organisms per 100 ml. found near the mouths of the Raisin and Detroit Rivers. Fecal coliform densities ranged from 5 to 30 percent of the total, and geometric mean fecal streptococci were less than 80 per 100 ml. at all locations.

All bathing beaches along the Michigan shore of Lake Erie had geometric mean coliform densities of less than 1,000 organisms per 100 ml., except Maple Beach, located in the influence of the Detroit River. Geometric mean coliform densities at Sterling State Park beaches approached 1,000 organisms per 100 ml., but here relatively low means mask exceptionally high individual values which appeared under certain conditions of wind and weather, some exceeding 100,000 organisms per 100 ml. These maximums represent a hazard to health of water users. Fecal coliform and fecal streptococcus densities along the Lake Erie beaches were noticeably higher than in adjacent Lake waters.

Bacteriological densities in Lake Erie from the mouth of the Detroit River to a point 2 to 3 miles to the south are such that the water cannot safely be used for recreational purposes. Following heavy rainfall in the Detroit area, the zone of polluted water extends southward to Stony Point and outward from the Raisin River.

Dissolved Oxygen. Most of the Michigan waters of Lake Erie display high levels of dissolved oxygen. Two areas of low values were found near the mouths of the Detroit and Raisin River, with the more widespread effect radiating southward from the mouth of the Detroit River. In the immediate vicinity of the mouth of the Raisin River, complete depletion of oxygen was found, but within one-half mile into the Lake the levels recovered. Values as low as 4.8 mg/l and 58% saturation were found in the area south of the mouth of the Detroit River. Here the area of depressed values extends southwest 4 -6 miles.

While present oxygen levels in the Lake do not yet cause major interferences with water use, the drop to 4.8 mg/l represents a threat to water uses in the Lake. Unless appropriate remedial action is taken now, the situation will almost certainly worsen.

Phenols. Average phenol concentration ranged from 1 to 16 micrograms per liter with 5 out of 23 Lake stations exceeding 2 microgram per liter. Nine out of 17 beach stations had phenols averaging over 2 micrograms per liter, but all were under 5 micrograms per liter, but only 2 exceeded 4 micrograms per liter.

Phenols can cause disagreeable tastes and odors in drinking water, taint the flesh of fish, and, in high concentrations, kill fish and other aquatic life. There is no evidence of damage to Lake Erie water use by phenols at this time.

Chlorides. Average chloride concentrations in the Michigan waters of Lake Erie ranged from 18 to 44 mg/l, with the higher values along shore and near the mouth of the Detroit River. Chlorides can interfere with domestic and industrial water use by causing objectionable tastes and odors in drinking water and corrosion in industrial equipment. While present levels do not interfere with water use, the year-by-year increase at the Monroe water intake is noted as a warning of future problems.

Suspended and Settleable Solids. Suspended solids concentrations near Lake Erie bathing beaches ranged from 30 - 165 mg/l; Lake Erie itself had concentrations of

11 to 25 mg/l. Suspended solids in Lake Erie were highest near the mouths of the Raisin and Detroit Rivers, and have reached levels which interfere with water uses by settling out on the Lake bottom. These bottom deposits interfere with navigation, kill fish eggs and fish-food organisms, destroy spawning beds, and clog the gills and respiratory passages of fish.

Cyanides. Cyanides were found at the mouth of the Raisin River and once at Sterling State Park nearby in concentrations exceeding PHS drinking water standards and recommended maximums for protection of fish. Their presence in the water, even in minute quantities, poses a threat to fish and wildlife.

Iron. Average iron concentrations exceeding 0.30 mg/l were found near the mouth of the Detroit and Raisin Rivers. Iron is toxic to certain species of fish even in low concentrations; excessive quantities of iron can also cause tastes in municipal water supplies and stains in laundry, vegetables and plumbing fixtures.

Nitrogen. A pattern of high concentrations of nitrogen compounds radiates outward from the Detroit River. High levels of nitrates ranging from 0.35 to 0.50 mg/l were found in Brest Bay, and ammonic concentrations exceeding 0.30 mg/l extended down into the Lake approximately 10 miles from the mouth of the Detroit River. Inorganic nitrogen exceeds 0.30 mg/l in over 85 percent of the Michigan waters of Lake Erie.

Nitrogen in Lake Erie acts as a nutrient for algae and undesirable slimes which, in turn, can result in obnoxious odors; ammonia in particular interferes with domestic water treatment.

Phosphates. Phosphates also nourish objectionable algae and slimes, which add to general turbidity. Areas of high total phosphate concentration (0.20 - 0.50 mg/l) extended from the Detroit River south to Stony Point. Three areas of soluble phosphate exceed 0.10 mg/l as phosphate or 0.03 as phosphorus. One extends 6 - 8 miles south from the mouth of the Detroit River, one radiates out 1 - 2 miles from the Raisin River, and the third extends upward 3 - 4 miles from the Ohio State Line.

Over 85 percent of the Michigan waters of Lake Erie contain inorganic nitrogen and soluble phosphates in excessive concentrations. The result has been undesirable algal blooms and serious interferences with water use. The City of Monroe has already been forced to move its water supply intake in order to avoid objectionable tastes and odors from algae.

Biology. Massive colonies of the filamentous slime bacteria Sphaerotilus, or "sewage fungus," and the filamentous green alga Cladophora were found at most stations in Lake Erie and along the bathing beaches near Bolles Harbor and in Brest Bay. These slimes, indicative of pollution, have fouled the nets of fishermen, interfered with boating, and washed up on beaches decaying and smelling.

Lake Erie also supports dense populations of plant and animal plankters, sometimes as dense as 22,425/ml. These microscopic, free-floating animals, in large numbers, can create nuisances: they clog filters in water plants, produce unpleasant tastes and odors in drinking water, and make the Lake water highly turbid.

Study of the bottom animal associations revealed polluted areas adjacent to the Raisin River and Sterling State Park, and at the mouth of the Detroit River extending in the shape of a fan out into the Lake. Samples from the River below sources of pollution and from the Lake did not contain a single burrowing mayfly. This elimination of pollution-sensitive organisms such as these rob fish of much food, and may threaten certain species of fish with extinction.

George L. Harlow

Sources and Characteristics of Wastes

Over 95 percent of the waste constituents discharged from Michigan sources to Lake Erie originates from the Detroit River. The daily discharge from the United States portion of the River into Lake Erie contains the following loadings:

1. Over 10,000,000 pounds of chlorides.
2. Over 2,000 pounds of phenols.
3. Over 7,000,000 pounds of settleable solids.
4. Over 250,000 pounds of iron.
5. Over 200,000 pounds of phosphates.
6. Over 130,000 pounds of ammonia.
7. Over 300,000 pounds of total nitrogen.

After the Detroit River, the major polluter of Michigan Lake Erie is the Raisin River. The chief municipal waste discharge to the Raisin is from Monroe. The Monroe Sewage Treatment Plant provides primary treatment and, during the summer, chlorination, and its operation is excellent. Efficiency in removal of suspended solids (62%) and BOD (59%) is high for a primary treatment plant, and bacterial control during chlorination is also good.

Although Monroe has separated its sewer system, a portion of the sanitary sewers still receives runoff from roofs during and after rainfall. This results in hydraulic overloading at the plant, with a subsequent drop in efficiency, especially in maintenance of a chlorine residual in the effluent which will adequately reduce coliform organisms.

During the summer most bacterial loadings discharged to the Raisin River and subsequently to Lake Erie from the Monroe plant are significantly less than those from industrial soures. During non-chlorination months, however, the municipal plant is a significant source of coliform organisms to the Raisin River. Nitrogen and phosphorus compounds in the River originate in almost equal proportions from industrial and municipal sources.

Monroe industries discharge, daily, to the Raisin River:

1. Wastes equivalent in oxygen consuming capacity to raw sewage from a population of 225,000.
2. Over 23,000 pounds of suspended solids, including 7,800 pounds of settleable solids.
3. Over 1,000 gallons of oil.
4. Over 1,000 pounds of cyanides.
5. Over 1,000 pounds of phosphates.
6. 16,000 pounds of chlorides.

George Harlow

7. Coliform bacteria with maximum densities more than 3 million per 100 ml.

8. Fecal coliforms with maximum densities more than 100,000 per ml.

9. Fecal streptococci with maximum densities more than 51,000 per 100 ml.

The lower Raisin River is frequently completely devoid of dissolved oxygen, resulting in a continuous state of putrefaction during the summer months. All uses of the lower Raisin River except waste disposal and navigation have been eliminated by pollution and deposits of settleable solids. Navigation is also hampered, and extensive annual dredging at the mouth is required to remove deposited wastes and keep the channels open for routine ship movement. Bacterial counts in the lower River make any recreational use of the water hazardous. The detrimental effect of the Raisin River upon the Lake is evident in the enrichment of the waters of the western basin and the high coliform levels at bathing beaches nearby (including Sterling State Park).

In addition to the Raisin River, several other tributaries to Lake Erie contribute wastes: They are the Huron River, Swan Creek, Stony Creek, Sandy Creek, Plum Creek and LaPlaisance Creek, with the Huron the most important. The Huron River carries significant quantities of coliform organisms, nitrates, and phosphates. It discharges into a large marsh at Pointe Mouillee with no clear pattern of dispersion into the Lake. The marsh is subject to backwater from the polluted waters of the Detroit River discharging into the Lake, and the specific effect of the Huron on the Lake is masked by this phenomenon. Long retention in the Point Mouillee marsh further complicates an evaluation of the Huron's share in polluting the Lake. After sources of pollution in the Detroit River have been substantially reduced, the actual waste contribution of the Huron River may be determined.

Sandy Creek discharges into Lake Erie at the northern edge of Sterling State Park, and is usually of poor bacteriological quality. Much of the time its flow is reversed, since the intake of the Ford Motor Co. plant and several paper mills that use its water exceed its normal flow. At periods of high runoff, however, its flow is higher (up to 60cfs), and on such occasions it had an adverse effect on Lake Erie water.

Stony Creek and a small boat harbor near its mouth also have high coliform densities, and in times of heavy rain contributed wastes to the Lake.

Another important source of waste discharge into Lake Erie is storm-caused overflow. All along Lake Erie are shorefront pumping stations designed to receive surface drainage and automatically discharge it, untreated, into the Lake during or following rainfall. Discharge from improperly functioning septic tanks reaches the pumping stations along with surface storm runoff. A portion of Monroe's sanitary sewers still receives roof runoff, and this burdens the sewage treatment plant which must bypass directly to the River, without treatment except chlorination, all wastes over 10 MGD. In addition, a flood relief pumping station along the Raisin River interceptor bypasses the plant when unusually heavy rainfall or flood stage of the River inundates the sewer. The effect of storm-caused overflow on the River is most evident above known sources of pollution. In August 1963 a heavy rain caused the flood pumping station to operate for one hour, and coliform densities jumped to 10 times normal levels.

Unsewered shorefront houses also discharge sewage directly, or from improperly functioning septic tanks, to Lake Erie. Several tributaries, including Plum Creek and Sandy Creek, also receive such wastes.

Commercial and pleasure boats make heavy use of the Michigan waters of Lake Erie, and all such craft represent potential sources of pollution from oil and human wastes. Several reports of oil spills in the middle of the Lake waters under study indicate actual pollution from these sources.

Special Studies

In connection with the overall study of Lake Erie, several special studies were carried out on specific pollution problems not clearly defined by the routine investigations. The special studies included: Three intensive surveys of the Raisin River, a pollution study of the Maple-Milleville Beach area, collection and analysis of bottom deposits in the Lake, hydrologic and current studies, and an investigation of bacterial contamination at Sterling State Park. (Results from the first three studies have been reported in the main body of this summary.)

Hydrologic Studies. The hydrologic studies showed, in general, that wind is the primary factor influencing water movement in the Michigan waters of Lake Erie except in the Detroit River debouchment where flow from the Detroit River is the predominant factor. Specific findings of special interest include the following:

1. The combination of wind patterns and Detroit River flow is such that polluted Detroit River

water can affect water quality at beaches as far south as Swan Creek 75 to 85% of the time.

2. Predominant winds are southerly, producing northerly currents 40 to 45% of the time. Northerly currents in turn bring polluted Raisin River water up to Sterling State Park beaches, accounting in part for the erratically high bacterial counts observed there.

3. Winds from the northeast and east, which occur approximately 20% of the time, could bring polluted Detroit River water into Brest Bay if they blew steadily two days or more.

Sterling State Park. Study of bacterial contamination at Sterling State Park beach revealed several sources of the pollution. The Raisin River, as mentioned above, is probably the chief contributor of high coliform counts, since northerly currents are predominant. When southerly currents prevail, waste discharges from tributaries to the north of the Park, and from malfunctioning septic tanks affect the beach water. Control of these sources of pollution should restore water quality at the Park to levels safe for swimming.

George L. Harlow

Interferences with Water Uses

Municipal Water Supply. Algal growths in Lake Erie have in the past caused serious taste and odor problems in the public water supply of Monroe, and threaten to do so again. Ammonia concentrations at the Monroe water intake tend to lessen the effectiveness of chlorination.

Industrial Water Supply. Increasing chloride levels are a warning of future difficulties, for chlorides can cause corrosion in industrial equipment. The Raisin River is so grossly polluted in its lower reaches that it is offensive to sight and smell, and undesirable as a source of industrial water supply.

Recreation. Restriction of recreational opportunities in Lake Erie and its Michigan tributaries may be the worst damage from pollution, inestimable in dollar figures. At beaches near the mouth of the Detroit River, any kind of water contact sports--even water skiing or boating--is hazardous. The beaches at Sterling State Park, in heavy demand by a metropolitan population of nearly four million (projected to reach 5½ million by 1980), have had to be posted as unsafe for swimming. The beaches themselves are often offensive due to the washing ashore of rotting plant life and decomposing matter of sewage and industrial origin.

Fish and Wildlife Propagation. Sludge deposits on the bottom of Lake Erie threaten to destroy the food and habitat that make life possible for game fish. Large areas of Michigan Lake Erie's bottom are inhabited only by pollution-tolerant organisms such as leeches and sludge-worms. Fish kills have been caused by discharges of oil and in 1960 a heavy discharge of untreated waste killed 10,000 to 12,000 ducks near the mouth of the Detroit River. Heavy algae blooms and dense populations of plankton add to the turbidity of the Lake water.

Navigation. Sludge deposits at the mouth of the Raisin and Detroit Rivers require expensive annual dredging to preserve routine navigability.

Eutrophication of the Lake. The natural aging of the Michigan waters of Lake Erie is being accelerated by the discharges of nutrients and organic wastes. If these discharges are not halted, fertilization in the Lake may increase until it becomes unusable for most purposes.

George Harlow

I. INTRODUCTION

Recommendations for abating water pollution interfering with water use in the Detroit River, the Michigan waters of Lake Erie, and their tributaries will be made in two groups: general recommendations, covering the broad objectives of pollution abatement in the Project area, followed by specific recommendations for the solution of particular problems. All recommendations concerning municipal and industrial wastes refer only to Michigan facilities whose discharges reach the Detroit River or Lake Erie either directly or through a tributary.

The specific recommendations are offered in addition to, and not in place of, the general recommendations.

The recommendations which limit the effluent concentration of a particular waste constituent are made with the goal of reduction of overall loadings from a facility. If changes in concentration are brought about by increased dilution, combination of outfalls, or other methods without reducing waste loading, a corresponding decrease in recommended waste concentrations will be required.

George Harlow

While artificial fertilization of the Michigan waters of Lake Erie is a severe problem, no recommendations are made at this time concerning the installation of specialized treatment facilities designed to reduce phosphorus and nitrogen compounds in the effluent of municipal waste treatment works. Proper operation of secondary treatment facilities of the activated sludge type will result in significantly greater removal of these constituents than that produced by primary treatment alone.

II. GENERAL RECOMMENDATIONS

The following are the general recommendations of the Detroit River-Lake Erie Project staff.

It is recommended that:

1. All municipalities provide a minimum of secondary treatment plus adequate disinfection of the effluent.

2. Sewerage systems with collection sewers terminating in adequate treatment facilities be provided in those areas along the Michigan shore of Lake Erie and the Detroit river where sewers do not now exist and homes discharge either raw wastes or septic tank effluent to the watercourse.

George Harlow

3. All industries in the area discharging waste material to the public waters maintain an inventory of all waste treatment equipment and supplies on the plant premises so that a minimum delay in effective waste treatment will result when replacement or repair is necessary.

4. A program be developed to reduce the likelihood of accidental spills of waste material to the river. In-plant surveys with the purpose of anticipating possible accidents are recommended.

5. All new sewerage facilities be designed to prevent the necessity of bypassing untreated wastes during maintenance and renovation operations.

6. Municipal waste treatment plants regularly analyze all waste constituents contributing to pollution found in significant quantities in their wastes, as specified by the Michigan Water Resources Commission.

7. Industries discharging wastes to the public streams furnish operating records to the Michigan Water Resources Commission containing information on waste discharges and concentrations as specified by the Commission.

8. Regular monitoring of the Detroit River, Lake Erie, and their tributaries be conducted cooperatively by the Michigan Water Resources Commission and the Public Health Service. Such monitoring should include regular

sampling of waste effluents and overflows from combined sewers. Use of aerial techniques for reconnaissance and pollution surveillance as practiced by the Michigan Water Resources Commission is encouraged and expansion of this activity recommended. Monitoring should include surveillance of oil discharge from vessels.

9. A PHS Water Pollution Control Surveillance Station (formerly National Water Quality Network Station) be established in the lower section of the Detroit River. This would be in addition to the network station now in operation at the head of the Detroit River. Two stations would illustrate the waste burden put into the Detroit River and the change in its condition as it flows toward the Lake as well as indicate changes in water quality after improvements have been made.

10. The U.S. Department of Health, Education, and Welfare, through the auspices of the International Joint Commission, bring to the attention of Canadian water pollution control authorities the significant waste contributions from Canadian sources on the Upper St. Clair River adversely affecting water quality in the United States section of the Detroit River. They should be encouraged to bring about more effective pollution abatement to protect downstream water use.

George L. Harlow

III. SPECIFIC RECOMMENDATIONS

A. Detroit River

1. Municipal Waste Treatment

Detroit (Belle Isle Sewage Treatment Plant)

This plant discharges an effluent of low waste concentrations, and treatment efficiency is within accepted limits for this type of facility. Total coliform and fecal streptococcus densities in the effluent were high (7,890,000 and 297,000) but should be expected in this type of plant without chlorination.

The City of Detroit plans to abandon this plant and pump sewage from Belle Isle across to the mainland and into the Detroit system. Such a plan is recommended as the most practical under the circumstances. Until this plan can be carried out, it is recommended that full-time chlorination of the plant effluent be instituted, capable of producing an effluent with monthly geometric mean coliform densities not exceeding 5,000/100ml. This recommendation is made to prevent interference with

George L. Harlow

municipal water supplies and recreational use of water.

Detroit (Main Treatment Plant)

Sewage influent at the Detroit plant is of average strength from the standpoint of BOD and suspended solids concentrations but contains high levels of waste constituents normally not associated with municipal wastes, including oil and grease, phenols, copper, iron, chromium, nickel, zinc, and lead.

Average phenol and oil concentrations in the effluent exceed 20 mg/l and 15 mg/l respectively. Ammonia-nitrogen concentrations and loadings in the effluent are excessive, as is the phosphate effluent concentration (36 mg/l and 145,000 lbs/day). Efficiency in removal of settleable solids (52%), suspended solids (39%), and BOD (17%) is poor, indicating an overloaded and in some respects inadequate primary facility (e.g., the holding time in the settling basins is less than one hour).

Bacteria removal during the survey was excellent and density in the effluent very low. This presumably was accomplished by raising the level of chlorination; and while averages during the survey do not correspond with mean monthly averages during the study period, they show that effective bacterial control can be accomplished.

Waste loadings from the main plant of the City of Detroit are not only responsible for a large part of the degredation of the waters of the lower Detroit River but also constitute a major source of nitrogen compounds and the major source of phosphates going into and contributing to the fertilization of Lake Erie. The major contribution of waste constituents from municipal sources being discharged into the Detroit River and subsequently into Lake Erie originates from this plant.

It is recommended that:

1. A minimum of secondary treatment facilities be provided capable of producing an effluent not to exceed:
    a. Suspended solids concentration of 35 mg/l
    b. Settleable solids concentration of 5 mg/l
    c. Ammonia concentration of 2 mg/l
    d. Phenol concentration of 20 micrograms per liter
    e. Oil concentration of 15 mg/l
    f. Biochemical oxygen demand of 20 mg/l
2. Bacterial reduction facilities be operated at levels capable of providing an effluent with a monthly geometric mean coliform density of less than 5,000

organisms per 100 ml.

3. A technical committee appointed by the conferees will evaluate actual phosphate removal of the secondary treatment plant after it is in operation. On the basis of this evaluation, if further facilities for the removal of phosphates are necessary, the conferees will consider making such a recommendation. A similar program will be put into effect concerning removal of nitrogen compounds.

The above recommendations have been made to prevent interference with domestic water supplies, recreational use of water, navigation, and fish and wildlife propagation.

Wayne County Sewage Treatment Plant (Wyandotte)

The plant was greatly overloaded when the Project began, and it was necessary to bypass untreated wastes for a portion of most days to the Detroit River. Enlargement of primary facilities was designed to alleviate this condition. The surveys performed at this plant by the Project staff were made on the original facilities, and do not reflect the recent enlargement program.

Two surveys at this plant revealed an influent sewage of average strength in terms of BOD and suspended solids, but with other waste constituents at levels normally not associated with domestic sewage (phenols, oil and grease, iron, chromium, cooper, cadmium, nickel, zinc and lead).

Average concentrations of suspended solids and settleable solids and discharges to the River were high during the two surveys. Average BOD in the effluent during the first survey was 120 mg/l, with a population equivalent of 132,000 discharges. Levels of nitrogen compounds were significant, and phosphate concentrations were at 40 mg/l (unusually high) with a loading of 7,200 pounds per day.

Bacteriological control was excellent during the first survey when chlorination of the effluent was practiced. Geometric mean densities for total coliforms, fecal coliforms, and fecal streptococci during the first survey were less than 100 organisms per 100 ml. Study of plant operation records reveals that these results were not typical, but it is encouraging to note once again that results in this magnitude can be obtained. During the second survey effluent chlorination was not practiced, and geometric means for total coliforms, fecal coliforms, and fecal streptococci exceeded one million per 100 ml.

Discharges of suspended solids, nitrogen compounds, phosphates, and organic matter from the Wyandotte plant contribute significantly to the degradation of the Detroit River and the fertilization of Lake Erie.

It is recommended that:

1. A minimum of secondary treatment facilities be provided capable of producing an effluent containing not more than:

   a. Suspended solids concentration of 35 mg/l

   b. Settleable solids concentration of 5 mg/l

   c. Oil concentration of 15 mg/l

   d. Biochemical oxygen demand of 20 mg/l

2. Bacterial reduction facilities be operated at levels capable of providing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

3. A technical committee appointed by the conferees will evaluate actual phosphate removal of the secondary treatment plant after it is in operation. On the basis of this evaluation, if further facilities for the removal of phosphates are necessary, the conferees will consider making such a recommendation. A similar program will be put into effect concerning removal of nitrogen compounds.

The above recommendations are made to protect recreational use of water, navigation, and fish and wildlife propagation.

George L. Harlow

Wayne County Sewage Treatment Plant (Trenton)

It is recommended that:

1. A minimum of secondary treatment facilities be provided capable of producing an effluent not to exceed:

    a. Suspended solids concentration of 35 mg/l

    b. Settleable solids concentration of 5 mg/l

2. Bacterial reduction facilities be operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

The above recommendations are made to prevent interference with recreational use of water and fish and wildlife propagation.

Wayne County Sewage Treatment Plant (Grosse Ile)

It is recommended that:

1. A minimum of secondary treatment facilities be provided capable of producing an effluent not to exceed:

    a. Suspended solids concentration of 35 mg/l

    b. Settleable solids concentration of 5 mg/l

2. Bacterial reduction facilities be operated at

levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

The above recommendations are made to prevent interference with recreational use of water and fish and wildlife propagation.

2. Industrial Waste Treatment

Upper Detroit River

Allied Chemical Corporation (Solvay Process)

Wastes from this plant have high concentrations of suspended and settleable solids, phenols, and chlorides. Chloride loadings from this source represent approximately 20 percent of the entire industrial loading to the Detroit River. Suspended and settleable solids loadings and effluent concentrations indicate a lack of waste control.

It is recommended that:

1. Facilities be provided capable of producing an effluent not to exceed:

   a. Suspended solids concentration of 35 mg/1

b. Settleable solids concentration of 5 mg/l

2. The industry begin investigation of satisfactory methods of disposing of chlorides and alternate methods of disposal of concentrated brines, such as subsurface disposal.

The above recommendations are made to prevent interference with navigation and fish and wildlife propagation and to protect municipal and industrial water supply.

Anaconda-American Brass Company

Wastes discharged from this source were not found to interfere with existing water uses in the Detroit River or Lake Erie.

Great Lakes Steel Corporation - Blast Furnace Divisions

Waste treatment facilities provided for the removal of phenols and suspended solids are ineffective. Nearly 100 percent of the suspended solids in the plant effluent were found to be readily settleable.

It is recommended that:

1. Facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/l

b. Settleable solids concentration of 5 mg/l

c. Phenol concentration of 20 micrograms per liter.

d. Ammonia concentration of 2 mg/l

The above recommendation is made to prevent interference with municipal water supplies, navigation, and fish and wildlife propagation.

Parke-Davis Company

Waste treatment at this installation is considered satisfactory at this time, and no specific recommendations for improvement are made.

Revere Copper and Brass, Inc.

The concentrations of oil and settleable solids in the effluent from this installation are excessive. All of the suspended solids released by this industry are readily settleable.

It is recommended that:

Facilities be provided capable of producing an effluent containing not more than:

a. Suspended solids concentration of 35 mg/l

b. Settleable solids concentration of 5 mg/l

c. Oil concentration of 15 mg/l

This recommendation is made to prevent interference with navigation and fish and wildlife propatation.

United States Rubber Company

Waste treatment at this installation is considered satisfactory at this time, and no specific recommendations are made.

Rouge River Industries

Allied Chemical Corporation (General Division)

Wastes discharged from this source were not found to interfere with existing water uses in the Detroit River or Michigan Lake Erie.

Allied Chemical Corporation (Plastics Division)

Wastes discharged from this source were not found to interfere with existing water uses in the Detroit River or Michigan Lake Erie.

Allied Chemical Corporation (Semet-Solvay)

Wastes discharged from this source, with the exception of oil discharges as reported by the Michigan Water Resources Commission, were not found to interfere with existing water uses in the Detroit River or Michigan Lake Erie.

Allied Chemical Corporation (Solvay Process)

Wastes from this plant have excessively high concentrations of phenols and chlorides. Chloride loadings represent approximately 10 per cent of the entire industrial load to the Detroit River. Suspended solids loadings averaged 10,000 pounds per day.

It is recommended that:

1. Facilities be provided capable of producing an effluent not to exceed:
    a. Suspended solids concentration of 35 mg/l
    b. Settleable solids concentration of 5 mg/l
2. The industry should begin investigations of satisfactory methods of disposing of chlorides and alternate methods of disposal of concentrated brine, such as subsur-

face disposal.

The above recommendations are made to prevent interference with navigation and fish and wildlife propagation and to protect municipal and industrial water supply.

American Agricultural Chemical Company

Waste treatment at this installation is considered satisfactory at this time, and no specific recommendations are made.

American Cement Corporation (Peerless Division)

Suspended solids, almost all of which are readily settleable, are present in excessive concentrations in the plant effluent. It is recommended that the effluent concentrations of suspended solids and settleable solids be limited to 35 mg/l and 5 mg/l, respectively.

The foregoing recommendation is made to prevent interference with navigation and fish and wildlife propagation.

George L. Harlow

Darling and Company

Survey reports indicate inadequate facilities for control of BOD and coliform organisms. This plant discharges to the Rouge, and subsequently to the Detroit River, wastes equivalent in oxygen-consuming capacity to the untreated wastes of over 40,000 persons.

It is recommended that:

Facilities be provided capable of producing an effluent not to exceed:

a. Monthly geometric mean coliform density of 5,000/100 ml

b. Biochemical oxygen demand of 20 mg/l

The above recommendations are made to protect municipal water supply and prevent interference with fish and wildlife propagation.

Ford Motor Company

Wastes from this plant represent, in volume, approximately 83 percent of the industrial wastes being discharged into the Rouge and subsequently into the Detroit River. Phenolic wastes exceed the limit of 600 pounds per day set by the Michigan Water Resources

Commission. Concentrations of iron, phenols, and oil exceed 17 mg/1, 20 micrograms per liter, and 15 mg/1, respectively. Suspended and especially settleable solids are excessive at times, while excellent control was achieved on other occasions. Acid discharged in the form of spent pickling liquor is excessive and imparts an unnatural color to the Rouge and Detroit Rivers.

Phenols, iron, and oil and grease from this industry constitute over 90 percent of the loading from industrial sources to the Rouge River. Improvement must be accomplished at this source if significant reduction in waste loadings to the Rouge River and subsequently to the Detroit River is to be effected.

It is recommended that:

1. Facilities be provided or existing facilities operated to produce an effluent not to exceed:
    a. Suspended solids concentration of 35 mg/1
    b. Settleable solids concentration of 5 mg/1
    c. Phenol concentration of 20 micrograms per liter.
    d. Ammonia concentration of 2 mg/1
    e. Iron concentration of 17 mg/1
2. Oil removal facilities be operated to limit the oil concentration in the effluent to 15 mg/1. In addition,

the industry should investigate methods of further reduction in oil discharged in the plant effluent by in-plant control.

The above recommendations are made to prevent interference with municipal water supplies, recreational use of water, navigation, and fish and wildlife propagation.

Scott Paper Company

The effluent contains excessive quantities of suspended solids. Over 31,000 pounds of suspended solids per day are discharged to the Rouge and subsequently to the Detroit River. This industry discharges to the receiving stream wastes equivalent in oxygen-consuming capacity to the untreated sewage from a population of over 500,000 persons.

It is recommended that facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/l

b. Settleable solids concentration of 5 mg/l

c. Biochemical oxygen demand of 85 mg/l

This recommendation is made to prevent interference with navigation and fish and wildlife propagation.

George L. Harlow

Chrysler Corporation (Amplex Division)

Pollution control is considered satisfactory at this time, and no specific recommendations for improvement are made.

Chrysler Corporation (Cycleweld Division)

Pollution control is considered satisfactory at this time, and no specific recommendations for improvement are made.

Chrysler Corporation (Engine Division)

Wastes discharged from this source were not found to interfere with existing water uses in the Detroit River or Michigan Lake Erie.

Dana Corporation

Wastes discharged from this source were not found to interfere with existing water uses in the Detroit River or Michigan Lake Erie.

George L. Harlow

E. I. du Pont de Nemours and Company
(Industrial and Biochemical Division)

This company was found not to be in compliance with the restriction on pH set for it by the Michigan Water Resources Commission.

Firestone Tire and Rubber Company

Excessive concentrations of iron were found in the plant effluent. Over 5,000 pounds per day of this substance were discharged to the Detroit River.

It is recommended that iron concentration in the effluent be reduced to levels not exceeding 17 mg/1.

The above recommendation is made to prevent interference with fish and wildlife propagation.

Fuel Oil Corporation

Excessive concentrations of oil were found in the effluent from this installation when ships were being washed. At these times the concentrations are over

300 mg/1.

No specific recommendations for improvement are made, since the Michigan Water Resources Commission has reported that this industry has recently suspended ship-washing operations. It is recommended not to permit resumption of such operations until controls are instituted to limit oil in the effluent to 15 mg/1.

Great Lakes Steel Corporation - Strip Mill

Excessive quantities of suspended solids and settleable solids are discharged to the Detroit River. Since the major portion of these suspended solids is readily settleable, it is recommended that the concentration of settleable solids be limited to 5 mg/1 and the concentration of suspended solids to 35 mg/1. The Michigan Water Resources Commission reports excessive oil discharges, and controls should be instituted to limit effluent to conform with the Commission's order.

This recommendation is made to prevent interference with navigation and fish and wildlife propagation.

George L. Harlow

Great Lakes Steel Corporation - Ecorse

Excessive concentrations and significant quantities of oil, iron, suspended solids, settleable solids, and acid are discharged. Over 50 percent of the iron and acid loadings to the Detroit River originate here. Effluents containing acid wastes are far below pH 5.5, and these wastes are mainly responsible for lowering the Detroit River below pH 4.0 in the vicinity of the plant.

It is recommended that:

1. Acid wastes be controlled so that discharges fall within the range pH 5.5-10.6.

2. Facilities be provided or existing facilities operated to produce an effluent not to exceed:

    a. Oil concentration of 15 mg/l

    b. Suspended solids concentration of 35 mg/l

    c. Settleable solids concentration of 5 mg/l

    d. Iron concentration of 17 mg/l

The foregoing recommendations are made to prevent interference with municipal water supplies, recreational use of waters, navigation, and fish and wildlife propagation.

George L. Harlow

Koppers Company

Waste discharges from this source were not found to interfere with existing water uses in the Detroit River or Michigan Lake Erie.

McLouth Steel Corporation - Gibraltar

Control of iron, oil, and suspended solids discharges at this plant is marginal, with improvement noted during the last months of study.

It is recommended that:

All waste treatment practices be reviewed and steps taken to improve the effluent to conform consistently to the Order of Determination issued by the Michigan Water Resources Commission.

McLouth Steel Corporation - Trenton

The waste treatment facilities of this installation have been very erratically operated from the standpoint of control of suspended solids, settleable solids, iron, phenols, oil, and pH. At times excellent treatment was achieved; at other times complete lack of treatment effectiveness was observed, with concentrations of solids, oil, phenols, and iron exceeding the Order of Determination of the Michigan Water Resources Commission.

Since it has been demonstrated that this industry can achieve effective pollution control by operation of its existing facilities, it is recommended that steps be taken to assure an effluent not to exceed:

a. Iron concentration of 17 mg/l

b. Suspended solids concentration of 35 mg/l

c. Settleable solids concentration of 5 mg/l

d. Oil concentration of 15 mg/l

Mobil Oil Company

During the survey the concentration of oil in the plant effluent was excessive, and additional grab samples before and after the survey indicated erratic operation. Effective operation of the industry's oil separation facilities should also improve suspended solids removal.

It is recommended that:

1. Existing facilities be operated effectively or additional facilities provided to assure an oil concen-

tration in the effluent not to exceed 15 mg/l at all times.

2. Suspended solids and settleable solids in the effluent be maintained below 35 mg/l and 5 mg/l.

The above recommendations are made to prevent interference with fish and wildlife propagation.

Monsanto Chemical Corporation

Waste treatment at this installation is satisfactory with the exception of phosphate concentrations and loadings in the plant effluent. Over 10,000 pounds per day of phosphates are discharged into the Detroit River.

It is recommended that treatment be provided to reduce concentrations and loadings of phosphates by approximately 80%.

The above recommendation is made to prevent interference with fish and wildlife propagation, recreation, and municipal water supply.

Pennsalt Chemical Corporation - West Plant

Wastes from this plant had excessive concentrations of phenols, suspended solids, and settleable solids. Phenol concentrations were found over 1,000 micrograms per liter but no interference with existing water uses in the Detroit River or Michigan Lake Erie was apparent at this time.

It is recommended that:

1. The entire waste disposal program of this plant be carefully investigated by company personnel, since discharge of phenols, oxidizing agents, and settleable solids is far in excess of that expected by company officials.

2. Facilities be provided or existing facilities operated to produce an effluent not exceeding:

   a. Suspended solids concentration of 35 mg/l

   b. Settleable solids concentration of 5 mg/l

The above recommendations are made to prevent interference with navigation and fish and wildlife propagation.

Shawinigan Resins Corporation and Monsanto Chemical Corporation (Saflex Division)

The wastes from these two plants are discharged to the Detroit River from a common lagoon. During the survey the only waste constituents considered excessive were BOD and suspended solids (originating primarily from Shawinigan Resins). The planned installation of a new lagoon after the survey should reduce these levels considerably; therefore no recommendations for improvement are made at this time.

Wyandotte Chemicals Corporation - North Plant

Concentrations of chlorides, suspended solids, and settleable solids in the plant effluent were excessive. The contribution of chlorides in the amount of 1,300,000 pounds per day represents almost half the entire industrial loading to the Detroit River. The suspended and settleable solids loadings from this industry represent 35 percent of the total loadings to the Detroit River from industrial sources.

The composition of the suspended solids (most of which are readily settleable) is mainly calcium carbonate. This chemical is only slightly soluble in water and will readily settle out in clarifiers. Sludge from this operation when discharged to the River will settle on the River and Lake Bottom and interfere with aquatic life.

It is recommended that:

George L. Harlow

1. Facilities be provided capable of producing an effluent not to exceed:

   a. Suspended solids concentration of 35 mg/l

   b. Settleable solids concentration of 5 mg/l

2. The industry continue investigation of satisfactory methods of disposing of chlorides, and alternate methods of disposal of concentrated brines, such as subsurface disposal.

These recommendations are made to prevent interference with navigation and fish and wildlife propagation and to protect municipal and industrial water supply.

Wyandotte Chemicals Corporation - South Plant

Heavily concentrated wastes are pumped from this plant to the waste beds of Fighting Island. The remainder of the plant effluent is discharged to the Detroit River and contains excessive concentrations of chlorides and suspended solids.

It is recommended that:

1. Facilities be provided capable of producing an effluent not to exceed:

   a. Suspended solids concentration of 35 mg/l

   b. Settleable solids concentration of 5 mg/l

2. The industry continue investigation of satisfactory methods of disposing of chlorides and alternate methods of disposal of concentrated brines, such as subsurface disposal.

These recommendations are made to prevent interference with navigation and fish and wildlife propagation and to protect municipal and industrial water supply.

Wyandotte Chemical Corporation - South Plant (Propylene Oxide)

Wastes discharged from this source were not found to interfere with existing water uses in the Detroit River or Michigan Lake Erie.

The maintenance of adequate levels of dissolved oxygen in the lower Raisin River is the mutual responsibility of all discharging oxygen-demanding wastes into the River. Each recommendation made in this regard is to be understood as part of this mutual responsibility, and no industry or municipality is singly responsible for achieving the recommended DO level.

George L. Harlow

1. Municipal Waste Treatment

Monroe Sewage Treatment Plant

Two surveys revealed an influent fairly typical of a weak domestic waste. Exceptions to this general observation include high concentrations of soluble and total phosphates and certain toxic metals, including copper, zinc, and lead. These constituents were present in approximately the same concentrations in the plant effluent.

Plant efficiency, as measured by percent removal of suspended solids and BOD, was very good for a primary sewage treatment plant. Bacterial control was effective during the first survey when the effluent was chlorinated but poor during the second survey when it was not. Study of operating records revealed that similar degrees of plant efficiency were maintained on a long-term basis. The operation of this plant is considered outstanding for an installation of this type, and the operating personnel are commended.

It is recommended that:

1. Treatment be provided capable of assuring

a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/l. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be operated at levels capable of providing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml. during the months of April through November.

3. The current plan of separating roof runoff from sanitary wastes to prevent overloading plant facilities be accelerated.

The above recommendations are made to prevent interference with recreational use of water and fish and wildlife propagation.

2. Industrial Waste Treatment

Enrico Fermi Atomic Reactor

Waste treatment was found to be satisfactory, and no specific recommendations are made at this time.

Consolidated Paper Company - North Plant

Significant quantities of suspended solids, settleable solids, and BOD are discharged into the Raisin

River and subsequently into Lake Erie. The wastes from this industry are equivalent in oxygen-consuming capacity to the untreated wastes from a population of over 100,000 persons, or approximately 45 percent of the total load to the Raisin River. Densities of coliform and fecal streptococcus organisms were also excessive.

It is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/1. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be provided and operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

3. Facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/1

b. Settleable solids concentration of 5 mg/1

The above recommendations are made to prevent interference with recreational use of water, navigation, and fish and wildlife propagation.

George L. Harlow

Consolidated Paper Company - South Plant

Significant quantities and high concentrations of suspended solids, settleable solids, and BOD are discharged into the Raisin River and subsequently into Lake Erie. The wastes from this industry are equivalent in oxygen-consuming capacity to the untreated wastes from a population of over 100,000 persons, or approximately 45 percent of the total load to the Raisin River. Densities of coliform and fecal streptococcus organisms were also excessive.

It is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/l. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be provided and operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

3. Facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/1

b. Settleable solids concentration of 5 mg/1

The above recommendations are made to prevent interference with recreational use of water, navigation, and fish and wildlife propagation.

Consolidated Paper Company - South Plant

Significant quantities and high concentrations of suspended solids, settleable solids, and BOD are discharged into the Raisin River and subsequently into Lake Erie. The wastes from this industry are equivalent in oxygen-consuming capacity to the untreated wastes of over 40,000 persons. Densities of coliform and fecal streptococcus organisms are unusually excessive, averaging over 1,000,000 total coliform organisms per 100 ml during the special survey.

It is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/1. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be provided and operated at levels capable of producing an effluent with

a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

3. Facilities be provided capable of producing an effluent not to exceed:

   a. Suspended solids concentration of 35 mg/1
   b. Settleable solids concentration of 5 mg/1

The above recommendations are made to prevent interference with recreational use of water, navigation, and fish and wildlife propagation.

Ford Motor Company

The discharge from this plant represents 80 percent of the total waste volume from industrial sources discharged to the Raisin River and subsequently into Lake Erie. Cyanide concentrations and loadings in the plant effluent are excessive. The effluent from the company-owned sewage treatment plant is not chlorinated. The quantity of oil released to the Raisin River through a dilution canal outlet is excessive even though the concentration remains below 15 mg/1.

It is recommended that:

1. Bacterial reduction facilities be provided

George L. Harlow

and operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

2. Treatment facilities be operated to limit the cyanide concentration in the plant effluent to 0.025 mg/l.

3. Oil removal facilities be provided to limit the concentrations of oil reaching the dilution canal from in-plant sources to 15 mg/l.

The foregoing recommendations are made to prevent interference with recreational use of water and fish and wildlife propagation.

Monroe Auto Equipment Company

Waste treatment at this installation is considered satisfactory at this time, and no specific recommendations for improvement are made.

Monroe Paper Products Company

Significant quantities and high concentrations of suspended solids, settleable solids, and BOD are discharged from this source into the Raisin River and subsequently into Lake Erie. The major portion of the suspended solids is readily settleable. Densities of coliform organisms were found to be excessive during the first survey at 32,400 organisms per 100 ml; however, during a separate Public Health Service survey several months later, the average coliform concentration exceeded 2,000,000 organisms per 100 ml.

It is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/l. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be provided and operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the months of April through November.

3. Facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/l

b. Settleable solids concentration of 5 mg/l

The above recommendations are made to prevent interference with recreational use of water, navigation, and fish and wildlife propagation.

Union Bag-Camp Paper Company
River Raisin Division

Signigicant quantities and high concentrations of suspended solids, settleable solids, and BOD are discharged from this installation to the Raisin River and subsequently into Lake Erie. The wastes from this industry are equivalent in oxygen-consuming capacity to the untreated wastes of 70,000 persons. A large part of the suspended solids was readily settleable.

It is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/l. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be provided and operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5,000 organisms per 100 ml during the month of April through November.

3. Facilities be provided capable of producing an effluent not exceeding:

a. Suspended solids concentration of 35 mg/l

b. Settleable solids concentration of 5 mg/l

The above recommendations are made to prevent interference with recreational use of water, navigation, and fish and wildlife propagation.

C. Special Problems

I. Overflows and Combined Sewers

Although the severe effect of overflows from combined sewers upon water quality in the Detroit River and limited areas of Michigan Lake Erie was demonstrated, a specific method of approach to the solution of this problem is not now evident.

It is recommended to the Michigan Water Resources Commission that it require a detailed engineering study be made to determine costs and select an effective method of control. It is also recommended that a report of these investigations, containing the method to be used to solve this problem and a time schedule for accomplishment, be submitted within two years to the Secretary of Health, Education, and Welfare.

It is further recommended that agencies

responsible for the current operation of combined sewer systems in the Detroit area immediately take steps to lessen the pollutional effects of malfunctioning overflow regulators by finding and correcting the cause of failure of these diversion devices and checking the operation of all overflows every day to determine if unnecessary overflows are occurring.

2. Federal Installations

U.S. Naval Air Station, Grosse Ile, Michigan

It is recommended that:

1. A separator capable of producing an effluent containing less than 15 mg/l oil be installed on the line receiving aircraft washing wastes.

2. Operation of existing sewage treatment facilities be improved by performing such procedures as breaking up scum in gas vents, reversal of flow at periodic intervals, more frequent withdrawal of sludge, and daily scraping of the sides of the sedimentation chamber.

3. Better operation records be maintained.

4. Continuous and effective chlorination of plant effluent be practiced to assure that the geometric mean coliform density does not exceed 2,400 organisms per

100 ml.

5. The outmoded septic tank installation at the boat dock be replaced with an aerobic digestion treatment unit providing primary and secondary treatment followed by chlorination of the effluent.

6. If the U. S. Naval Air Station does not close on or before September 1, 1967, as scheduled, one of two alternatives be followed:

a. Connection to the municipal sewage collection and treatment system proposed for construction at Grosse Ile.

b. Enlargement of the present naval facilities to include secondary treatment as proposed in the original plans.

At this writing the Navy has agreed to all of the foregoing recommendations and has already taken steps to accomplish all but the last recommendation.

U. S. Corps of Engineers Dredging Operations

It is recommended that:

1. The hopper dredges discontinue disposing of the ship's trash and garbage at the Raisin River dumping grounds.

2. Suitable treatment units be installed aboard ship to adequately dispose of all sanitary wastes including trash, garbage, and human excreta.

3. Closer control be exercised to minimize the loss of dredge material from the hoppers while proceeding to the dumping grounds.

4. A vigorous attempt be made by the Corps of Engineers to reduce the amount of dredging with action leading to reduction of discharge of settleable material by increasing the charges to polluters for removing the material commensurate with the damages to water uses incurred. (It is believed that it was not the intent of Congress that such dredging operations should provide a method of disposal of solid material deposited by individuals or corporations in navigable streams.) It is desirable not only that dredged channels be maintained but that every means possible be taken to keep the cost of such maintenance to a minimum.

The District Engineer has agreed to take steps to see that the recommendations are put into effect. He reiterated that the Corps of Engineers does charge the polluters for removing the material commensurate with the damages to water uses incurred and that the Corps of Engineers does not have any statutory authority to prevent the original discharge of the material to the navigable waterway. He also stressed the responsibility of the Corps of Engineers in enforcing Federal legislation relative to discharge of waste materials from vessels into navigable waters.

3. Sterling State Park

These recommendations repeat those already given for specific areas; they are listed here to emphasize what is necessary to abate water pollution at Sterling State Park.

A. The Consolidated Paper Company, Union Bag-Camp Paper Company, and Monroe Paper Products Company. It is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/l. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be provided and operated at levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5000 organisms per 100 ml during the months of April through November.

George L. Harlow

3. Facilities be provided capable of producing an effluent not to exceed:

a. Suspended solids concentration of 35 mg/l

b. Settleable solids concentration of 5 mg/l

B. The Ford Motor Company. It is recommended that:

1. Bacterial reduction facilities be provided and operated at the levels capable of producing an effluent with a monthly geometric mean coliform density of less than 5000 organisms per 100 ml during the months of April through November.

2. Treatment facilities be operated to limit the cyanide concentration in the plant effluent to 0.025 mg/l.

3. The current plan of separating roof runoff from sanitary wastes to prevent overloading plant facilities be accelerated.

C. The City of Monroe. It is recommended that:

1. Treatment be provided capable of assuring a minimum dissolved oxygen concentration in the Raisin River below this source of 3 mg/l. Any plan for achieving this goal should include secondary treatment as a minimum.

2. Bacterial reduction facilities be operated at levels capable of providing an effluent with a monthly geometric mean coliform density of less than 5000 organisms

per 100 ml during the months of April through November.

3. The current plan of separating roof runoff from sanitary wastes to prevent overloading plant facilities be accelerated.

D. In the area north of Sterling State Park between Sandy Creek and Stony Creek, it is recommended that measures be taken to eliminate direct and indirect discharge of sanitary sewage to Lake Erie. It is also recommended that discharge of sanitary wastes to the storm pumping stations be eliminated.

E. Septic tanks tend to function poorly due to the nature of the soil and the high water table. It is recommended that shorefront communities having septic tanks and direct discharge installations be sewered and the wastes transported to a sewage treatment plant providing adequate treatment and chlorination.

F. It is recommended that the practice of allowing discharge of raw and septic tank effluent from the suburban area outside Monroe to surface drains be discontinued. This material is discharged into the Raisin River during heavy rainfall. It is further recommended that the area be sewered with sanitary wastes transported to a sewage treatment plant providing adequate treatment and chlorination.

The foregoing recommendations are listed in the order of greatest importance to improving water quality at the Sterling State Park.

MR. STEIN: Thank you very much, Mr. Harlow, for an excellent report. I am very happy to have had you up here. This is really very, very fine.

MR. HARLOW: Thank you, Mr. Chairman.

MR. STEIN: You know, Mr. Harlow's father used to be the Chief Finance Officer in the Public Health Service when I was about Mr. Harlow's age and working there. Now I guess I'm getting to be the older man. These things change.

Thank you very much.

Mr. Poston?

MR. POSTON: This concludes the Public Health Service presentation, but in line with procedures at other conferences, we request other Federal agencies to make statements if they wish.

At this time, Mr. Premetz of the Bureau of Commercial Fisheries, Fish and Wildlife Service, has a statement. I have copies of this here, which he has kindly made available.

Mr. Premetz.

STATEMENT OF ERNEST PREMETZ,
BUREAU OF COMMERCIAL FISHERIES,
U. S. DEPARTMENT OF THE INTERIOR,
5 RESEARCH DRIVE, ANN ARBOR, MICHIGAN

MR. PREMETZ: Mr. Chairman, Conferees and Ladies and Gentlemen:

The safeguarding and perpetuation of the fishery resources of the Great Lakes is a major responsibility of the U. S. Fish and Wildlife Service and its two Bureaus. Any practice or series of events which threatens fisheries directly or militates against the well-being of natural stocks even in the most subtle manner is of primary and overriding concern to us. We have repeatedly pointed out during the past 10 years that changes were occurring in the environment: changes that seriously threatened the resource. Our warnings in the early years were largely unheeded. In fact, many of our people were labeled alarmists. Our statement presented at the first conference March 27, 1962, clearly pointed out that the status of the Detroit River and western Lake Erie as a useful freshwater resource had become uncertain and that immediate and stringent effective control of pollution offered our only avenue of escape. We wish to reiterate that stand at this time.

Frequently, water quality may become so degraded and competing water uses so detrimental that fishes and those who use them are in trouble long before the more obvious issues of human safety and welfare are threatened. Before the "public is aroused" valuable fisheries and the waters that produce them are lost or so deteriorated that great effort and expense are necessary for rehabilitation. We urge, therefore, a broad concept of pollution; a definition not necessarily restricted to bacterial counts, excesses of dissolved solids, gross deficiencies in dissolved oxygen or easily detectable changes in bottom fauna composition. We urge the establishment of water quality standards that have prevention of pollution as a goal; not a set of limits that will define the degree of deterioration to be tolerated before action is taken to avert a national disgrace.

We propose the establishment of acceptable and adjustable limits on quantities of phosphorous, nitrogen and other basic nutrients or trace elements that trigger cycles of biological productivity frequently as damaging to natural waters as the original sources of so-called pollution. Of course, this proposal calls for research and development in chemical engineering and the techniques of treatment, a challenge any nation like ours should accept enthusiastically. Given such facility, we envision the deliberate environmental adjustments in the aquatic realm that have made agriculture in this country the envy of the world. We must and can learn to manipulate our "outfalls," effluents or whatever we may call them to serve our ever-increasing population. We must abandon the concept of "waste discharge" in favor of the positive approach of "by-product use" to improve our capabilities in aquatic as well as terrestrial management.

Our scientists have reviewed the statement prepared by the Public Health Service relative to pollution of the Detroit River, Michigan waters of Lake Erie, and their tributaries. The Fish and Wildlife Service strongly supports the recommendations therein.

We have been pleased to actively support the Public Health Service in this action. Our scientists have made a major contribution to the report before you, both directly and indirectly. We were fortunate in having a large backlog of scientific information obtained over a long period of years. This information, plus that still being obtained, has been and will be made available to the Public Health Service. We pledge to continue to apply the full measure of our scientific competence to this problem and to cooperate with all agencies to "save our lakes." A Great Society cannot tolerate the continuation of a situation that is fast becoming a national disgrace.

As directed and authorized by Congress, the Fish and Wildlife Service will continue its examination of lake and stream environments for water quality and ecological appraisal within the Great Lakes Basin.

Experience has taught us that, frequently, troubles within one portion of this vast drainage have their origins in other, often remote, portions. We must become aware and remain cognizant of the occurrences in the Great Lakes that may threaten any portion of fish and wildlife. We must also strive to develop means of restoring fishes that already have become victims of situations created by the carelessness, greed and short-sighted planning of parts of our society.

We intend to oppose vigorously any actions that might aggravate an already deplorable situation in the Lake Erie drainage. There is no place for us but in the forefront of any and all efforts to restore clean water conditions in this important and very productive

Lake. Our studies of changes in bottom fauna, exhaustion of oxygen content over much of the central basin, and serious reduction in fishes of great value are conclusive in support of this policy.

Unless the practices which have induced these deplorable conditions are stopped and the trends toward further deterioration are reversed, Lake Erie will become worthless as a fish producer and a scab on the landscape of the America we are trying to beautify

MR. STEIN: Thank you, Mr. Premetz, for a very helpful statement.

As always, the Department of the Interior has been a real ally in the field of water pollution control, and I suspect we will continue to work with you through the years.

Thank you very much.

MR. PREMETZ: We certainly are happy to cooperate.

Time does not permit me to go into a description of some of the research that is going on at the moment, but I think we will come up with some very worthwhile answers that can be applied to this problem.

MR. STEIN: Thank you.

At this point, we would like to call on Mr. Oeming of Michigan.

MR. OEMING:

MR. OEMING: Mr. Chairman, fellow Conferees, Members of the Commission, Ladies and Gentlemen:

I take great pleasure at this time in introducing to you Governor George Romney of the State of Michigan.

Governor Romney.

(Rising applause.)

STATEMENT OF HONORABLE GEORGE ROMNEY, GOVERNOR OF THE STATE OF MICHIGAN

GOVERNOR ROMNEY: Thank you very much.

We are very fortunate to have with us here today Governor James Rhodes of Ohio. He has taken a great interest in this problem of water pollution. He called a meeting down in Cleveland about six or seven weeks ago that several of us attended, and took a good look at the situation in Lake Erie.

He is a tough competitor for us right now, because he is after our business up here. And when I say "a tough competitor," I have a favorite definition of a competitor.

They say a competitor is a fellow who goes in the revolving door behind you and comes out ahead of you.

(Laughter.)

Well, I have determined that he is not going to get ahead of us in that revolving door, but we are glad to have him here on a matter of great and mutual interest, namely, the water situation in the Great Lakes, and you are going to hear from him when I get through.

I have a talk here that I need to make because it has been given out to the press.

(Laughter and applause.)

Chairman Stein, Mr. Poston, Loring Oeming, and members of our Water Resources Commission, Chairman George McIntyre, John Vogt, George Liddle, Ralph MacMullan, Lynn Baldwin and Al Balden:

This is a timely meeting, and one that I am very hopeful will accomplish its purpose.

Today has been filled with a number of different things for me. I started out this morning by going out to Willow Run to meet the astronauts, and I heard about the space walk and the lack of pressure up in space.

I have just come from a national convention on crime, and I have come here to a conference on water pollution in the Art Gallery. I don't know why it is here, but I hope the location will help to purify the water.

(Laughter.)

I think it is safe to say that there is no other single element, not even air, which evokes such an intense response from our people as does water, and what is done and not done to it. Whether it is fluoridation or swimming or just plain lawn sprinkling bans, we seem to get more wrought up about what happens to water than almost anything else.

Of course, there is a reason for this, because water is fundamental to industry, to agriculture, to recreation, and to life itself. Water, good water, is a possession to be richly cherished.

As a matter of fact, we don't really appreciate, in this modern age in America, how blessed we are with water. I can remember attending a hearing of the National Recovery Administration, at which hearing Mr. A. V. Davis, who helped establish the Aluminum Company of America and helped produce the first pound of aluminum in this country, was testifying, and they were questioning him about the bauxite mines down in Arkansas.

He was asked, "What did the company ever do for the people down there besides give some of them employment?"

And he said, "We brought them water."

Those people at that hearing didn't realize how important that was, because the people down in that area used to walk 10 and 15 miles to get water, or travel as far to get water, until they brought water to them.

Governor George Romney

Water is something that we are greatly blessed with, and here in Michigan we are extremely fortunate to have four of the Great Lakes lapped against our shores, and to have more than 11,000 inland lakes, and 36,000 miles of streams, so we have plenty of water and we have a primary State interest and responsibility for what happens to this water.

For this reason, the danger of pollution of water is of utmost importance to Michigan, because a good deal of our future is related to how we handle our water.

Let there be no mistake. The pollution of our water is a big problem and a growing problem. As a matter of fact, I am of the opinion that we are treating our water as carelessly as we did our forests earlier, and that we must intensify our efforts. But at the same time, I am aware that we are doing a good deal at the present time. We are not doing as much as we should, but we are working at it.

I think we also need to recognize that we can't expect our water to be as pure as it was before we began to utilize it for municipal purposes, industrial purposes, agricultural, and recreational purposes.

Certainly we cannot tolerate the befouling of our streams and lakes with raw sewage, agricultural chemicals, and poisonous industrial wastes, and I can say with some first-hand knowledge that Michigan is known throughout the United States as a State with a progressive and substantial pollution control program.

Of course, we are hopeful that this conference will help us to do a better job, and, for that reason, let's take a look at some of the goals of this meeting. There are three, as I understand it.

First, to consider the Public Health Service report on the Michigan waters of the Detroit River and Lake Erie;

Second, to evaluate the present status of our State and local pollution control activities, and ascertain the nature of delays, if any, that are encountered in abating pollution; and

Third, to agree upon additional measures that may be necessary to attain and keep the level of quality in our water which we should reasonably expect.

Under the leadership of our State Water Resources Commission, Health Department, and Conservation Department, and with the active cooperation of industries and municipalities, Michigan has already progressed more than is acknowledged in controlling water pollution.

Our programs were started many years ago, and they have been carried on with patience and care. They have involved the expenditure of many millions of dollars by both private industry and by Local and State Government.

In Michigan, sewage treatment under State supervision is almost universal in those communities that have sewage systems. The few exceptions involve waste disposal of doubtful significance, or involve communities which have already embarked upon plant construction projects.

Industry is the subject of unremitting State attention and is generally in compliance with the several hundred orders which have been issued to its waste disposing plants. These orders have been largely preventive as against the actual pollution situations calling for additional corrective orders.

Aggressive pollution control programs, pursued diligently in Michigan for many years, have had general acceptance and support by our citizens. Our legislature has been responsive to the needs by providing the statutory authority that meets the changing habits, customs and desires of our people.

But in spite of hundreds of millions of dollars spent for waste collection and treatment, as is

Governor George Romney

well known to you, many problems not only in water use but also in water management are emerging and growing much more complex and difficult.

To protect the State's primary interest and responsibility, it is urgent that we define and thoroughly understand these problems, that we evaluate their effects on civic public needs, and that we develop a coherent up-to-date realistic water policy for the sound management and use of our water resources, because they are there to be used, not just looked at.

One of the several steps we are trying to take to meet this challenge is the development of a complete water policy for the State, encompassing all areas of water resources, management, use, and rights.

We have never taken a look at the total problem in this State. We have dealt with it piecemeal, and consequently, a little over a year ago, I appointed a Commission on Water Rights Use and Pollution to devote their efforts to accomplish a 7-point program involving a complete and total look at water rights, use and pollution in the State of Michigan.

I am not going to read in detail the seven points, but they are comprehensive in their character, because insofar as our inland lakes and waters are concerned, clearly we must be responsible for them.

As far as the Great Lakes are concerned, obviously they have interstate and international aspects that involve the Federal Government and Canadian Government, and other states, as well as Michigan.

In looking ahead to the findings and recommendations of this commission or task force that I have appointed, we can gain confidence in the past and the underlying attitudes of our industries and communities.

The Michigan statute equates pollution control with injury prevention requirements, as must any conceivable statute that is founded upon the common law and the Constitutional due process requirements. A person may not be required to refrain from carrying out an activity which does not unreasonably injure another.

Nevertheless, without asking for proof of injury, the Detroit River industries years ago voluntarily terminated their one time general practice of discharging raw human sewage in the river. The files of the Water Resources Commission record that this item alone cost one of the companies involved some three million dollars.

Many of the industrial waste improvements date from an industrywide conference that was held 19 years ago this spring, at which time the Water Resources

Commission proposed objectives which it believed Detroit River industries should achieve.

Since then, the record shows that the following reductions have been made in waste going into the Detroit River:

Oil is down 80 percent;

Phenol is down 78 percent;

Cyanide is down 71 percent;

Ammonia is down 47 percent; and

Suspended solids are down 63 percent.

So there has been some progress in cutting down the solids and other products that are going into the river, and these are just examples of the progress, much of it voluntary and cooperative, which underlies our confidence that the response to any new objectives which may be established will be equally gratifying.

I am reliably informed that further major projects are ready to be taken off the drawing boards waiting only upon making sure that they meet such definite new objectives.

I believe, based on what I have seen in this report and what I know about it, that one of the things we must be sure of is that if we do certain things, we can reasonably expect to achieve certain results. And

Governor George Romney

I assume that is one of the major purposes of this Conference, not only to evaluate the pollution that is going into the river, but also to evaluate various means of dealing with that pollution and determining whether or not they will be effective.

This contingency ties in with another aspect of Federal determination to be based upon the subject here being reported, the determination as to the nature of delays, if any, being encountered in abating the pollution.

While certain projects have been able to move forward without interruption by the study, it has obviously been necessary for waste disposers to defer major expenditures for new waste control measures pending clarification of just what might be expected of them. Hopefully, if we can establish clear-cut facts with respect to injury, and facts with respect to how we can overcome that injury, we can see some early progress.

The State is prepared to assume its primary obligation in this matter before us today in seeking, by all possible means, to achieve and preserve a water quality that is consistent with the many needs that are involved. However, it is perfectly apparent from the facts in the report that this is essentially a local community problem and private industrial problem insofar as the

Detroit River is concerned, and I assume that in the course of this conference, the extent to which it has interstate implications and, therefore, Federal involvement and responsibility, will be considered and developed as well.

Any future goals must certainly be framed in the realities of what can be supported by law, and must be fair and equitable to all concerned.

Quite probably, two categories of goals will be settled upon -- the musts -- those that must be met in order to prevent or abate injuries as defined by law; and the desirables -- those that should be continually worked toward to produce additional improvements in quality beyond that required by law.

Both categories will, I am sure, have the full attention of our State pollution control agencies.

It is obvious, but still tremendously important, that we should also approach the job ahead prepared to deal not just with chemicals and construction projects, but with the attitudes and beliefs of people who are concerned about their water. We have to think of those who are coming along after us, and their need to have these water resources, so we have to be prudent and, most of all, those of us who share the public trust are committed to see to it that this resource is treated with care, so that this State will continue to be a water wonderland.

And so I am hopeful that this conference will be a useful conference in determining specific things that need to be established in order to make further progress, the precise character of pollution, the magnitude of it and seriousness of it in terms of injury, the specific steps that can be taken, and how much assurance there is that those steps will produce a given result, and then areas of responsibility involving private groups and governmental groups.

Personally, I wish I could sit in the full five day conference, but that doesn't seem to be a possibility under the present legislative circumstances in this State, and, of course, that is something completely beyond my control, but I wish those of you who are able to participate fully complete success in arriving at answers to some of these points.

Thank you very much.

(Applause.)

Now I am very happy to have an opportunity to introduce again a great Governor from a great State. This man is a man who has had extensive public experience, and he is a man that gets results. He is very practical, along with idealistic and realistic, and he has a great record of accomplishment.

We are very fortunate to have with us here this afternoon Governor James Rhodes of Ohio.

Governor Rhodes.

(Rising Applause.)

STATEMENT OF HONORABLE JAMES RHODES, GOVERNOR OF THE STATE OF OHIO

GOVERNOR RHODES: No one need stand up. No one from Ohio is going to stand up.

(Laughter.

I know that George and I sometimes agree that we are most important, being Governors of great States such as Michigan and the great State of Ohio. Recently, I assisted a lady across the street in the City of Columbus, and while helping her across the street, battling a traffic light, I placed her on the curb some ten minutes later.

I knew by the questions she asked me that she must have been 91 or 92 years of age. She looked at me and she said, "Young man, may I do anything for you?"

I said, "Yes. One of these days you may be able to vote for me."

She looked me straight in the eye, and she said, "What are you running for?"

I said, "I'm running for Governor."

Governor James Rhodes

She said, "I'll be glad to do anything to throw those bums out of the State House."

(Laughter.)

I know that I stand here as an Ohio State man, sometimes in a state of mixed emotions, because we are supposed to be the football capital in certain years, and the football fever in Columbus, Ohio and the surrounding territory is contagious. The only cure for it is a good defeat.

I want to say that we have recuperated on many occasions, but I can reminisce, as a young man on the campus on the night before the Michigan game, even going to Ann Arbor or in the City of Columbus, of the great relationship between these two great universities, with the air filled with chants and songs to work up to a fever-pitch the enthusiasm of all the fans of Ohio in that great Buckeye battle cry, and the one that they always finished with, George, was the one they always sang, students and adults.

"We don't give a damn for the whole State of Michigan. We're from Ohio."

I stand here with mixed emotions. I enjoy that as an Ohio State man, but Michigan happens to be the largest employer and the largest taxpayer, with the base industry in the State of Michigan, so I do care about the State of Michigan.

You have a great Governor. I have been associated with George since his inception here as your chief executive. Not only does he believe in everything that is good, in something that builds and constructs a community, but he is also very progressive.

I have taken under consideration the pollution problem of the Great Lakes, and I have attempted to look at it from the overall picture.

In the area of the Great Lakes, we pay 47 percent of all the taxes in these United States of America. We represent 41 percent of the people.

Lake Erie and the surrounding lakes here in this area constitute only part of the problem of the Great Lakes. I said this on May 10th in the City of Cleveland, when George very graciously and kindly attended that meeting, that this is a problem that is too large for one State, and we do need assistance.

If we are to preserve and protect more or less the manufacturing breadbasket of America and this nation, we need the assistance, the aid, and the help of the Federal Government.

I am not talking about it on the police

actions, I am not talking about it just being law enforcement, but I am talking about an overall program to salvage and to save the Great Lakes.

I am particularly concerned about Lake Erie, and I know, out of this symposium and this meeting -- and I might say in passing, with no reflection, that we have had more meetings, more forums, more symposiums, more conferences on the Great Lakes on pollution, and on Lake Erie, than anything that I know of except the Bible, and I think the time now is for action. We should do everything that we possibly can do as State officials and also as local officials to cooperate and to welcome the increased effort of the State and local agencies and industries for accelerated pollution abatement efforts now being taken in all States in the Great Lakes area.

I would like to repeat what has been said many times. We are past the talking stage and the study stage. We have arrived at the point where we have to consult the consultants, who are consulting the consulting engineers.

Ladies and gentlemen, there is much at stake in an anti-pollution program, and the stake happens to be industry. In industry there happen to be jobs, and without jobs, we all know what unemployment happens to be. The only answer to unemployment happens to be employment. I know that in the gross national product in this great State you want to be above the national average. I know deep down George Romney is concerned for more jobs here in the State of Michigan and the expansion of industry.

What we are talking about is to have and to hold what we do have, so that we can work basically in the industrial expansion of the great States in the Great Lakes area.

We must recognize that pollution of Lake Erie is interstate, intrastate and international, and therefore it should be evident that our Federal Government has a primary responsibility.

Our national resources require stewardship obtainable only through funds and jurisdiction beyond the boundaries of each of the States of the Great Lakes district.

I know that there will be more meetings. We welcome you in the Great Lakes, the Federal Government, the Department of Health, Education, and Welfare, and we welcome you with open arms and with a complete atmosphere and environment of a comprehensive cooperative program.

Governor James Rhodes

We can only bring about results if reasonable people sit around the table with reasonable ideas and respect for other people's thinking concerning this problem. This is the only way the problem can be solved. This is no time where one State has to shout over the back fence at another State.

The problem of the Great Lakes and the State of Michigan happens to be the problem of the Great Lakes and the State of Ohio. I want to assure you that I have come to George Romney on many occasions, and we stand together, and I think that we can speak for the rest of the Governors, that all we are attempting to do is to clean up the Great Lakes and protect what we have.

The future of the growth and the space for the economic expansion of the Great Lakes area depends upon how diligently and how sincerely we go about our job of cleaning up the Great Lakes area, and this can only be accomplished -- and I repeat -- by the complete and comprehensive cooperation of all concerned.

I want to thank you for asking me up here, George. Again, I want to repeat, you were very kind to come to the City of Cleveland on May the 10th. I want to assure you of our complete cooperation.

I know there is going to be no controversy between the States. All we have is a common goal, and that is to clean up Lake Erie, especially from our side. I notice you have your own problems, but the time has passed when it becomes a partisan point of view. This is no time for petty partisanship.

It is the duty and responsibility and obligation of Democrats and Republicans alike to clean up the Great Lakes area.

I want to say that cleaning up pollution and providing the future for these great States, and especially the great industrial complex that they possess, is more important than the combined effort of all leaders of both parties.

I want to pledge to you and to everyone here today, the Federal Government people and the local officials, that you will have our utmost cooperation in your effort to do one of the most noble jobs in these United States of America.

Thank you.

(Applause.)

MR. STEIN: Thank you very much, Governors.

I want to assure you that we, in the Federal Government, share your views.

I don't think that there is any problem that we see from the Federal level in the field of water pollution control that will receive higher priority and a higher commitment of funds and personnel until we have the problem of the Great Lakes licked.

As I pointed out here, the Great Lakes are the greatest single source of fresh water in this continent and perhaps the world. If the Great Lakes go as many other fresh water lakes have gone, it will be a devastating blow to this region, and an equally severe blow to the nation as a whole.

The eternal mystery that we have had in this continent is that the Great Lakes have remained fresh, and we intend to keep them so.

Thank you very much for coming.

We will stand recessed for 15 minutes.

(Whereupon, a short recess was taken.)

MR. STEIN: May we reconvene?

At this time, it is indeed a pleasure to have another Congressman with us, in addition to Congressman Dingell who was here this morning.

We have a new Congressman who, in his own right, is a distinguished scientist, and that is very rare in the Congress -- perhaps very rare anywhere -- and a man who has evidenced a good deal of interest in water pollution control since he has come to the Congress, and before. He has a tremendous grasp of the subject and, because of his unique background and qualifications, brings new insight and new ideas to the subject.

At this time, I would like to present Congressman Vivian of Michigan.

Congressman Vivian.

(Applause.)

Representative W. E. Vivian

STATEMENT OF UNITED STATES
REPRESENTATIVE WESTON E.
VIVIAN, 2d DISTRICT, STATE
OF MICHIGAN

CONGRESSMAN VIVIAN: Thank you very much.

I am very pleased to be here this afternoon. Like Governor Romney, I just had the pleasure of being host to two astronauts and their wives, and I must say they are very fine, excellent people.

I am from the 2nd District of Michigan. To those of you who know the Congressional Districts, that is, in part, the Monroe area.

You have heard John Dingell and Bill Ford already. You can characterize John's district and my own as downriver, and anyone in the pollution business knows what "downriver" means. It doesn't just mean where the boats go down.

Our people in that district do have severe problems with pollution, and I think the findings of the Detroit River - Lake Erie Project clearly indicate -- beyond any doubt -- that the Detroit River and Michigan waters of Lake Erie are grossly polluted. The project found that the waters contain excessive coliform densities, excessive quantities of phenols, excessive quantities of iron, oil, ammonia, of suspended solids, settleable solids, of chlorides, nitrogen compounds, and phosphates.

Day after day, for example, huge amounts of suspended and settleable solids were found to be discharged by municipalities and industries into the Detroit River. Each day, over 7,000,000 pounds of these settleable solids flow into Lake Erie from the United States portion of the River. In fact, over 95 percent of the waste constituents discharged from Michigan sources into Lake Erie originate from the Detroit River.

Extensive and troublesome sludge banks have formed near the mouth of the River and out into the Lake. These deposits of sludge, due to suspended and settleable solids, are composed of organic or other material having an oily appearance and odor of sewage and containing large amounts of waste-associated materials such as phenols, nitrogen, phosphates and iron, with high percentages of volatile materials.

Second - oil and grease.

Representative W. E. Vivian

Oil and grease have significantly degraded water quality in the conference area. At least 20,000 gallons of oil per day are discharged from municipal and industrial sources in the area.

Third - coliform densities.

In the Detroit River below the Rouge River and below the outfall from the Detroit Sewage Treatment Plant, the coliform densities are consistently greater than 1,000 coliform organisms per 100 ml. of water, the widely used standard for water suitable for swimming.

These excessive coliform densities, these excessive amounts of oil and grease, of suspended and settleable solids and sludge deposits are but a few of the indicators of the severe pollution of the Detroit River and Michigan waters of Lake Erie.

That was argued. I don't think it can be argued any more.

2. IMPACT OF POLLUTION ON AREA COMMUNITIES

The pollution of these waters affects both the health and welfare of people of this area.

Bacterial pollution, as indicated by coliform densities, from partially treated municipal wastes and from overflows from combined sewers, interferes with domestic water supplies, presenting a health hazard in some areas if the water treatment facilities should break down. Bacterial pollution also interferes with recreational uses. All the beach areas on the Detroit River below Belle Isle have been posted as unsafe for swimming and other water contact recreation. Water contact sports, such as water skiing or boating in these areas, are hazardous. High bacteriological densities at the beaches of Sterling State Park further down the Lake also have caused this recreational area to be posted as unsafe for swimming.

Oil and grease are not only unsightly, but deface boats, boating equipment, and docking facilities.

The destruction in 1960 of from 10,000 to 12,000 ducks near the mouth of the Detroit River has been attributed to oil pollution.

The sludge deposits in the River create unfavorable environmental conditions for the propagation of game fish. Sludge deposits along the shoreline and in the marinas interfere with recreational use and aesthetic enjoyment of the water. These deposits also interfere with navigation, requiring annual dredging operations to maintain channels, marinas, and harbor facilities.

Now some people tend to believe that since remedial measures to abate pollution are very expensive, we shall have to allow the pollution to continue unabated. This is a false notion. Pollution of the Detroit River and Lake Erie not only endangers health, and deprives people of certain water uses, but it is costing the taxpayers a lot of money as well.

I noticed earlier that Governor Rhodes mentioned the problem of jobs. That is only one of many facets.

The recreational usefulness of most of the Detroit River and of some beaches on Lake Erie has been greatly diminished, as you well know. This restriction of recreational opportunities in this area, in my opinion, may be the worst, most expensive, damage from pollution, inestimable in dollar figures.

It is clear that the pollution of the Detroit River and Lake Erie endangers the health and welfare of our people, people of my own district, minimizes the potentially great recreational usefulness of the area, and degrades our capacity for industrial growth and development.

Representative W. E. Vivian

3. NEED FOR ACTION NOW

But more locally, in my own district the extent of pollution of the Raisin River is sufficient that it now is undesirable as a source of industrial water supply. Even though none of the industries in the conference area have gone out of business because of the deteriorated quality of the water, nevertheless, if water quality deteriorates much further, it is likely that some industries will be forced to change their source of water supply from river water to the more expensive city water. And that is a rather serious result from a situation which should have never gotten that bad.

The pollution of these waters also increases the cost of water for domestic uses. At detroit, an expensive treatment process is required to produce palatable drinking water, particularly for removal of the phenols.

The taxpayer pays sizeable costs for maintenance dredging to remove sludges, caused by inadequate treatment of waste by municipalities and industries. For example, maintenance dredging operations in the Rouge River by the Army Corps of Engineers cost $206,288 and $258,524 in 1963. To help defray the cost of this dredging, various industries were charged an amount commensurate with the cost of removing that portion of the bottom deposits resulting from their waste discharges. That is a complicated sentence, and the result is almost as complicated.

But, because it is difficult to identify the sources of all material deposited on the bottom of the river, few industries are charged for dredging cost--and these few pay only a small portion of the actual costs. Only four industries discharging to the Rouge River participated in payments of the dredging costs in 1962. Out of the total cost of $206,288 in 1962, the payments of the four industries amounted to $26,857. In 1963, these industries on the Rouge River paid $52,250 of the total cost now risen to $258,524.

For the Raisin River, the costs of maintenance dredging by the Corps of Engineers were $58,774 in 1962, and $128,536 in 1963. Only one industry is charged to help defray the cost of dredging in the Raisin River. Its fixed annual fee is $5,000, out of a yearly cost of $128,000.

The taxpayer--that is you--pays the difference between actual cost of the dredging operations and the amount paid by industry.

Representative W. E. Vivian

Although this present pollution of the Detroit River and Lake Erie presents a serious problem today, we can expect the situation to become even worse in the future, if the pollution continues unabated.

Between 1960 and 1980 it is expected that the population of the four-county project area will increase 40 per cent, from 3.9 million to 5.5 million. This growth should greatly increase the demand for municipal water.

In these same years, naturally the predicted rate of industrial growth and expected demand for industrial water is greater than the predicted rate of population increase. Consequently, industrial waste discharges will probably increase more rapidly than municipal sewage discharges will increase.

The conclusion to be derived from these data and these predictions is very simple.

Unless effective pollution control is achieved, the increased burden of waste discharges in the Detroit River and Lake Erie will degrade the water still further--intolerably further. At the same time the increased demand for clean water for all uses will accelerate the economic costs of pollution.

It should be apparent to all that we must take action to abate the pollution, and now. I am glad to hear that Governor Rhodes has made that easy. But why did the situation get so bad?

4. WHY DID THE SITUATION GET SO BAD?

As the Detroit area grew from a frontier city toward its present status as an industrial metropolis, few of the local units of government provided adequate collection and treatment. The wastes from each small community did not at first create a pollution problem. My wife, for example, lives north of Detroit in the Flint area, and only very recently was that area required to put in pollution control; but fortunately it now has.

But, eventually, the wastes from the many growing communities did create a recognized--then a severe--problem.

Early in this century a study of the pollution of the Detroit River was undertaken to determine the causes of high incidences of typhoid fever and other gastroenteric diseases that occurred here year after year. At that time, there was no sewage treatment at all for municipal wastes. Industrial wastes then were of very little consequence.

By the mid 1940s, many years ago, the City of Detroit and some of the other municipalities in the Detroit area had begun to provide extensive sewage treatment. However, by this time, the population of the area had tripled compared to its population at the beginning of the century, and the sewage treatment had not kept pace with the wastes from the expanding population. Also, in this short period of time, the area had become highly industrialized and the wastes from the factories further complicated the area's pollution problems.

By now, all the municipalities in the Detroit area provide some sewage treatment. But we still have not progressed far enough. Improved treatment, adequate disinfection, and an effective means of dealing with the overflows from the combined sewers are now necessary to reduce the bacterial contamination of the River.

Now, I have mentioned Detroit's history, because in Monroe County it is somewhat more subtle and perhaps more insidious and troublesome.

As we have seen, the pollution of the Detroit River and Lake Erie did not happen overnight. But in Monroe County, which is the part of my District involved in this conference, the pollution problem appeared with deceptive slowness. The City of Monroe began as an area for trading with the rural countryside, independent of the larger cities nearby, Detroit, Toledo, and so on.

Later, the Monroe beaches developed into a recreational area for the people of Detroit and Toledo. Summer cottages were built on or near the water. Each community in that summer beach area made little, if any, provision for sewage treatment. At first, these cottages were occupied only for short periods of each summer. It is as if an area were suddently built,without resizing, with a more constant population. No obvious signs of sewage disposal problems or pollution problems were evident. However, during the past two decades, people gradually have begun to occupy these homes the year around.

With a more constant population, schools and other public facilities were needed and built. Heavy industry moved into the area. Expansion was rapid. But sewage treatment still was keyed to the summer cottage era. Each home had treatment facilities of some sort, but there was no standard for communities to hold to. The immediate concern of each community was to dispose of its own wastes. Little thought was given to the total effect of the wastes from all the small communities and the new industries in the area on the receiving streams and downstream users. So that you see the pollution problem has jumped into being there rather than grown through several conferences in Detroit.

Communities in this area have been devoting their limited financial resources principally to desperately needed schools. You cannot complain when you discover there are tax and loan bases. Their borrowing bases are almost all used up because of schools.

But the pollution problem, which had been developing insidiously over a period of years, is now no longer deferable. It poses a serious threat to the area. It has become a major issue.

Today, the City of Monroe provides primary treatment for its wastes, and chlorinates the effluent during the summer months. The "Report on Pollution of the Detroit River, Michigan Waters of Lake Erie, and their Tributaries," which you are all familiar with now, has described the operation of the Monroe Sewage Treatment Plant as "efficient" and "outstanding" for a primary sewage treatment plant (p. 50). But, as the Report indicates, this is no longer adequate: Secondary treatment has become a necessity for the area. Even the city must move ahead, as well as the beach areas.

The growing townships in the Monroe area provide virtually no treatment. As with the communities in the rest of the conference area, the City of Monroe and its neighbors must now provide more extensive collection lines and a higher level of treatment--just to maintain minimum water standards, ignoring the problems of expansion.

5. WHAT STEPS WE MUST TAKE.

Some of these are obvious. Most of the major pollution problems of the Detroit River and Lake Erie area are not technically difficult to solve. It is apparent that the pollution of the waters of the River and the Lake is caused by waste discharges from identifiable municipal and industrial sources. Sanitary engineers today have the technical knowledge to treat most of the troublesome waste constituents discharged; and as years go by we learn how to deal with them more effectively and less expensively. Certainly, the answer to the major pollution problems in this area is a higher level of waste treatment by municipalities and industries; and as a person representing the area to the south I can only say that we must improve ours. Yes, we must ask and demand that the area to the north of us, the Detroit area, does the same.

Further, provision must be made for the future needs of the area: Plans must be made to expand the capacity of the present plants to handle future growth.

The solution for providing adequate industrial waste treatment is similar: Better treatment must be provided now, and provision made for future growth.

I personally have been considering the appropriateness of legislation at the Federal level which would reward industry for proper waste treatment, perhaps in the form of accelerated or partial tax write-offs for capital expenditures for waste treatment facilities. Attention will be given to this in the future.

Once an effective remedial program begins to bring the principal municipal and industrial sources of pollution under better control, we can and must then devote our energies to the more complex problems, and there certainly are some. For example, overflows from combined sewers must be brought under control. And effective and practical means must be found to remove certain waste constituents, such as chlorides from the water. This may take some time, and considerable expense, but I believe both the time and the money will be very well spent; and some day we shall have to tackle the question of whether or not runoffs from the agricultural land now heavily fertilized is a factor or not. At the present moment we cannot recognize that because we are so deep under the other constituents.

The only ingredient for success presently missing is money. The necessary construction, improvement, and expansion of treatment facilities and collection lines will cost a lot of money. The estimates run from hundreds of millions to billions; and I do not know the exact answer. But the expense of adequate sewage treatment is more than balanced by the benefits, both social and economic, to be derived from clean water.

The present polluted condition of the water causes heavy social and economic loss to the community. It has been estimated that the improvement of sewage treatment facilities for the City of Detroit will cost approximately $100,000,000; and that probably is low. By comparison, the improvement of the treatment facilities at Monroe, a much smaller task, is estimated to cost less than $1,000,000; perhaps $500,000. But the improvement of this will be considerable, not only for the City of Monroe, but for the residents of the beach areas further downriver, which you are all aware of, and on which I will be sending the information to my constituents so that they may be more aware of it.

6. ROLE OF THE FEDERAL GOVERNMENT IN ASSISTANCE AND ENFORCEMENT

While the residents of the four-county project area certainly will be obligated to pay a sizeable fraction of the cost of improved treatment facilities, there will, fortunately, be available appreciable Federal assistance. Some Federal funds are available through the Construction Grants Program. As you may be aware, proposed Federal legislation, which has recently passed in the House of Representatives, should double the size of grants and increase the amount of funds available for distribution. This legislation is intended to--and should--stimulate communities to cooperate with each other in the creation of joint waste treatment facilities, which is the only practical course for many of the smaller townships.

The people of Michigan pay the third highest amount of Federal taxes in the country. Of the total of $112.3 billion Federal tax dollars collected, the State of Michigan pays $9.4 billion, a little over 8 per cent. By comparison, our population is but 4.5 of the total national population. In other words, on a proportionate basis we might have paid approximately 5 billion and we pay 9 billion. It seems to me that extra 4½ billion is not too unreasonable to expect some of it to come back to us for paying for the cost of water pollution improvement.

Thus, more than a fair measure of the available Federal assistance has been paid by Michigan's tax dollars. Even those of you who do not like tax dollars, in the Federal Government, I suggest you re-think the question.

I would encourage our local governments to take full advantage of the Federal funds available to them for the improvement of waste treatment facilities.

Now, I hope that this Federal-State Conference has made apparent to all the scope, the seriousness, and the urgency of this area's pollution problems. This conference is a necessary and important step. It is a legal step and a required step. And, at the conclusion of the conference, just as before, each municipality and industry in the area will retain, for a good period of time, its opportunity to solve its pollution problems itself. It cannot complain about

Federal or State enforcement for quite some period of time. It can only be ashamed of its own inaction.

I am confident that if all concerned spend the time, effort, and money required to improve this area's waters, now certainly befouled by pollution, much of their former usefulness and beauty can be restored--and their economic value increased manyfold.

I would urge that each municipality and industry voluntarily start work on improvement as quickly as possible. I intend to search out the proper means of rewarding industry for initiating necessary and proper waste treatment procedures. Each municipality should certainly immediately seek appropriate State and Federal assistance.

We Congressmen down in Washington are down there for the purpose of being bothered on this type of mission. That is what we are there for. I personally intend to do whatever I can to help obtain Federal funds for pollution control measures in this area--and to help get the job done.

But keep in mind that, particularly now that the government of Ohio has started a legal chain for the interstate control of water pollution, the Federal officials can no longer sit back and wait. They have an obligation to act in a prescribed and legally determined manner. All of those of you who start acting by your own initiative now will be able to do the job well the way you think it should be done. If you wait, people at this table will have no alternative but to put on some pressure, and I shall have no alternative than to help them, so I suggest that you take the opportunity which exists and do your best.

I thank you very much.

MR. STEIN: Thank you, Congressman.

Are there any comments or questions?

(There was no response.)

MR. STEIN: Other than the Governors, I think you are the first one to get applause, Congressman.

CONGRESSMAN VIVIAN: Thank you.

MR. STEIN: And I think that this demonstrates that the Congressman is what is known in the trade to us in Washington as a working Congressman. This you can see.

He has thoroughly digested the report, and analyzed it, and in a busy Congressman's day, this is quite something.

I do believe that Congressman Vivian has made a substantial contribution to the thinking of the Conferees, and I am sure through the years he will make a substantial contribution to the Federal, State, and local water pollution control program through his position in the Congress.

He has, as you can see, one of the best grasps of the pollution problem. It is descriptive of what has happened in Detroit, and what happens in a situation where the community of Monroe found itself transformed from a resort community into a community where people live all year round and found itself without the necessary facilities, which only too well reflects the problem we find in communities throughout the country in the problem of water pollution control. I don't think I have ever heard it stated better than it was by Congressman Vivian.

We now have two letters which have come in. One is dated June 11th, and is addressed to me here. It says:

"Dear Mr. Stein:

"The Gibraltar Waterways Association of Gibraltar, Michigan is, and has been, gravely concerned with the problem of pollution in the lower Detroit River and Lake Erie. We disagree completely and emphatically with the public statements made by Mr. Gerald Remus, General Manager of the City Water Commission of Detroit, in which he has attempted to refute findings of the Public Health Service in connection with the gross negligence of the City of Detroit, other municipalities along the lower Detroit River and various industries located in the area. We are convinced Mr. Remus is completely ignorant of the fact of water pollution caused directly or indirectly by the City of Detroit or he is deliberately minimizing the hazards caused to the citizens of the lower Detroit River region and to the fish and wildlife of the area. We of the Gibraltar Waterways Association are in complete accord with the findings of the Federal Health Study in connection with this problem of pollution and we request this letter be placed in your record for the General Session which will review conclusions of the three year Federal study.

"I, Charles Dodge, Mr. R. B. Busby, and others of the Executive Committee as well as Mr. John Chascsa, Chairman of the Lake Erie Clean-Up Committee, and Mr. Edward Miliman, Chairman of the Rivers and Harbors Committee of the Pte. Moulee Boosters Club have obtained many samples of the polluted waters in the lower Detroit and Lake Erie area and have ample proof of the grave pollution in these waters. Many of these samples have been given our Gibraltar Municipal Officials for submission to the proper water resources commission with no apparent results of acknowledgements thereto. Thousands of ducks and fish have been killed by the pollution in the Detroit River caused by the untreated or partially treated sewage of the City of Detroit and other municipalities as well as industrial wastes along the Detroit River and Lake Erie that have contributed to this pollution.

"During the week of December 24, 1960, and

10 days between November 10 and 30 of 1963, the City of Detroit dumped millions of gallons of untreated sewage in the Detroit River, relying on the protection of a 36-year-old state law, but directly caused by the failure of the City of Detroit to furnish auxiliary equipment for the treatment of sewage.

"In connection with these acts of negligence on the part of the City of Detroit, the Mayor of the City of Riverview, Mr. James Jones, stated, 'This is just a license for pollution. I sympathize with Detroit's problem, but industry is forced to find other methods for repairs. Detroit should be made to do this also.'

"Some little time ago an expert long distance swimmer in attempting to swim from Belle Isle was forced to leave the waters because of extreme pollution encountered. Not many years ago the canals and bays of the City of Gibraltar and the lower Detroit River were desirable swimming and fishing locations. This is no longer the case and even boats operating in these waters must have their hulls cleaned frequently of the accumulated filth and pollution.

"We believe a strong Federal law penalizing offenders who contribute to the pollution of the Detroit River, either directly or indirectly, will help in making these waters, and the lands that adjoin them, fit places for human recreation, human habitation, and wildlife refuges, and will help to preserve the attractiveness of this Water Wonderland.

"Much of the damage that has been done will take years, following the clean-up of these waters, to be repaired and possibly these waters will never again regain a complete state of desirability."

Signed "Sincerely yours, Gibraltar Waterways Association Executive Committee, by Charles Dodge, President."

We have another letter here from the Gibraltar Democratic Club, dated June 1, 1965, and it reads:

"Dear Mr. Stein:

"The Gibraltar Democratic Club of Gibraltar, Michigan and located at the lower end of the Detroit River wishes to take issue with the statements made by Mr. Gerald Remus, General Manager of the City Water Commission of Detroit. We also request this letter be accepted as part of the record of this Second Session which will review conclusions of the three year Federal Study.

"Mr. John Chascsa of the Lake Erie Cleanup Committee; Mr. Charles Dodge of the Gibraltar Waterways

Association and Mr. Edward Miliman of the Pointe Moulee Boosters Club have ample proof with multiple samples in jars and also visual aids (slides) to disprove even the mildest criticism by Mr. Remus.

"In April of 1960, the Michigan Waters Commission pointed fingers of guilt directly at the City of Detroit and McLouth Steel Corporation for oil and sludge pollution in the lower Detroit River (the Gibraltar area) that caused the deaths of an estimated 10,000 ducks during a three week period.

"Several days duringthe week of December 24, 1960 tragedy seemed imminent for wintering wild ducks on the Detroit River when a 1,000 horsepower motor broke down at the Connor Sanitary Pumping Station, necessitating diversion of 425 gallons of UNRESTRICTED sewage into the River each second. THE CITY OF DETROIT DID NOT HAVE AUXILLIARY (STAND-BY) EQUIPMENT.

"For 10 days, between November 10 and 30, 1963 the City of Detroit dumped millions of gallons of UNTREATED sewage into the Detroit River. The City of Detroit obtained this legal permission to do so with the protection of a 36 year old State law. Two sluice gates at the City of Detroit's Fairview Pumping Station were in need of repair so the City of Detroit wrangled permission to by-pass sewage treatment facilities for approximately 10 days. Again the City of Detroit was derelict in not having auxiliary equipment.

"At that time the Mayor of Riverview, James Jones, stated 'This is just a license for pollution. I sympathize with Detroit's problem, but Industry is forced to find other methods for repairs. Detroit should be made to do this also.'

"Judd Arnett, writing in the Detroit Free Press Sunday, May 16, 1965 had these observations. 'Take a color picture of the River below Detroit. Then talk with people living down-river in the Gibraltar area. Middle-aged people remember swimming and fishing in many canals and channels there (Gibraltar). But, when I was there a year ago, I wondered if it was safe to keep a boat in the area. THE ONLY GOOD THING IS THAT THE WATER IS SO POISONOUS THAT WEEDS WON'T GROW IN IT.'

"What Mr. Arnett is really summing up is what our 16th District Democratic Congressman John D. Dingell has stated quite emphatically, that:

Pollution exists and is a serious threat to all,

the offenders are known,

25% of Lake Erie is dead due to growth of algae,

years of cheap solutions are now an expensive proposition,

to safeguard our natural resources - long deliberately neglected or advantages taken of - positive action must now be taken,

the Federal released report, after 2 1/2 years of extensive investigation, exposes all offenders whereas a private report has the tendency of smoothing over the worst offenders and 'snow' the public.

"In conclusion, we feel a strong Federal Bill would aid tremendously in requiring Cities and Industries to improve their waste facilities. A suggested penalty of $10,000 fine plus $10,000 per day until that particular offense has been corrected by either City or Industry.

"Members of your staff are invited to take a boat ride in the Gibraltar area. We would welcome the opportunity to show you, first hand, why Mr. Remus would not take up Senator John McCaulley from Wyandotte on his challenge to drink, swim or participate in any way with the waters of the Detroit River below the City of Detroit."

Signed, "George Darga, President."

Now, I might say members of our staff have been taking both boat trips and sampling in the Detroit area and in the Gibraltar area for the past couple of years. We did have a boat trip yesterday, accompanied by several people here, and the press.

I do have a handwritten letter here from the Cleveland Chamber of Commerce. It says:

"Dear Mr. Stein:

"I have attended this conference as a representative of the Cleveland Chamber of Commerce.

"Any efforts of our community to minimize its contribution to Lake Erie pollution would be of no avail unless progress is also made in the Detroit River, and other Michigan Rivers flowing into the Lake.

"We feel this conference is setting the proper course and trust that its costly aspects can be imposed with a tolerant consideration of the competitive nature of industrial enterprise.

"It occurs to us that an outcome of the conference should point to closer cooperation with the Canadian Government in an effort to reduce waste discharges on the opposite shore."

This is signed, "Sincerely yours, Albert G. Moore."

I am happy to have read that letter. I have to say that this is the first commendation we have ever gotten in an enforcement action from a chamber of commerce, even though it may only go halfway. We welcome it indeed. Maybe this is a turning point in the history of enforcement of pollution in the country. I hope so.

I have another letter from the City of Gibraltar, dated June 14, 1965, and it reads:

"Dear Sir:

"Attached herewith a copy of a resolution adopted by the City Council of the City of Gibraltar at its meeting of June 14, 1965 in reference to pollution of the navigable waters of the Detroit River and Lake Erie."

Attached is the following:

"WHEREAS The City of Gibraltar has received an official communication from the State of Michigan Water Resources Commission to the effect that the Secretary of Health, Education, and Welfare, Anthony B. Celebrezze, has issued a call for a conference on the pollution of the navigable waters of the Detroit River and Lake Erie starting Tuesday, June 15, 1965; and

"WHEREAS The City of Gibraltar is desirous of submitting a written statement relative to the aforesaid pollution,

Murray Stein

"BE IT RESOLVED That the City of Gibraltar officially notify Anthony B. Celebrezze, the Secretary of Health, Education, and Welfare, that the City of Gibraltar respectfully requests the following, to wit:

"1. That the United States Congress enact legislation with definitive standards and the imposition of substantial penalties, with the provision of assessment of additional penalties for continuing violations.

"2. That the United States Congress appropriate Federal aid to all Municipalities adjacent to the Detroit River and Lake Erie for the correction of defective sewage systems.

"3. That the United States Congress appropriate sufficient funds for the policing and enforcing of pollution legislation.

"4. That legislation be enacted sufficiently inclusive to govern the acts of all Municipalities, Industry and Commerce with a moratorium not to exceed a period of one (1) year from the effective date of said legislation, with the further provision that failure to comply within the moratorium period shall constitute an injunctive and restraining relief to the Government."

This contains the seal of the City of Gibraltar, and it reflects "Council Proceedings: 6-14-65."

Are there any further communications?

(There was no response.)

MR. STEIN: If not, we are going to anticipate what we have tomorrow for the people here. I expect that first off, we will have the clarifying questions from Michigan. That is when I suspect things will begin to get interesting. We will have the Federal experts here to answer these questions and see how much of an agreement we can come to.

Then the State of Michigan will present its report, and, after that, the State of Michigan will call on its invitees.

We are moving ahead in this conference right on schedule. I am very gratified by the progress we have made in the presentations.

We will recess now until 9:30 tomorrow morning, at the same place.

(Whereupon, at 4:45 p.m., an adjournment was taken until Wednesday, June 16, 1965 at 9:30 a.m.)

☆ U.S. GOVERNMENT PRINTING OFFICE : 1965 O - 792-121 (Vol. 3)